RAILROAD GAZETTE

FRIDAY, OCT. 9.

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Contributions.

Cattle Guards—A Correction.

CHICAGO, Ill., Oct. 5, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In my communication concerning cattle guards in your issue of the 2d inst. please note corrections as follows:

In the second paragraph it reads: "Nature inflicts pain as a deterrent to activities or movements which are attended with pain." It should read, which are attended with danger.

In third paragraph it reads: "There is no form of obstacle that an animal in search of food will not overcome." It should read, will not attempt to overcome.

BENJAMIN REECE.

Locomotive Economy.

BUFFALO, Sept. 26, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In my communication of the 19th inst. I appealed for more light on the compound matter, and it appears in the issue of this week from La Paz, by "A. B.," and he shows from the tables in the article on "Comparative test of Johnstone's Compound Locomotive," published in your issue of May 22, 1891, that the compound made a saving of 26 per cent. in cost of fuel over the simple engine. Surely this is enough to startle the railroad world; and if these results are proved it would be culpable on the part of railroad managers not to change their whole equipment to compounds.

This calls attention to the tests of the Johnstone compound, as reported in the article mentioned, and after a careful examination of that report I am assured that "our own child gets the best of care." In lieu of the tables 2, 3 and 4 I submit one made from data given in them, showing the average performance of the two engines duringsix trips each, and will also point to several matters which should be explained before we accept the report as having nothing the matter with it.

TABLE NO. 1.

Averages of tables 2, 3 and 4 of article on tests on Johnstone's compound, showing six trips each, engines 66 and 107.

	Compound engine 66.	Ordinary engine 107.
Total hours on trip	13:05	11:28
Actual running time	9:3	7:50
No. of cars in train	14⅛	15⅛
Total weight of trains, including locomotives, tons of 2,000 lbs.	493 83	456.33
Total units of work performed	1,613	1,453
Pounds of coal consumed	12.015	13,583
Pounds of water used	72,333	78,833
Units of work per ton of coal	268.33	214
Units of work per ton of water	44.5	37.8

By these figures we find that there is an apparent saving of 20.7 per cent. in fuel burned by the compound over the simple engine. But will the figures bear examination? Although the simple engine is accredited with an average of 15⅛ cars in train, and the compound with 14¼, still the simple engine's average train has only 456.33 tons in weight, including engines, to 493.83 tons for the compound, a difference of 37.50 tons, with an average of one more car. No one will contend that it is more economical to draw 100 tons on, say 5 cars, than on 4 cars; but the reverse is the case. The unfortunate simple engine could hardly have been fairly treated in always getting the short end of the stick.

Again we might notice that for some reason the compound was the better steamer, as the evaporation shows 6.02 lbs. of water per pound of coal for the compound, while the simple engine (from some cause) only shows 5.81 pounds per pound of coal. Hardly any one will claim that the cylinders or valve motion have anything to do with the evaporating qualities of the boiler.

But I find that the simple engine is still more unfortunate in the fact that for the days she ran in this trial a different factor was necessary for reducing the tons of weight of train, to work units; as, for the compound the factor is 3.26, while for the simple the factor is 3.18, a difference of 2.5 per cent in favor of the compound.

But that unfortunate simple engine also had to draw her train faster than the compound, as will be noted by the time on the road and also the actual running time as reported. In railroad dynamics speed has not yet been considered an element of economy.

It is very evident that the trials reported, or rather the reports of the trials, in this case are not entirely reliable, and although the figures shown may prove that the compound has given 20 to 26 per cent. economy in the cost of fuel, some of us must doubt the value of the figures. Certainly there should be some explanation why trains with an average of 28.18 tons per loaded car were chosen for the compound, and why those with an average of 23.2 tons per loaded car were chosen for the simple engine, if the figures for weights are correct.

By the face of the returns we have here the compound ahead say 25 per cent., while her competitor had the longer trains, run faster, etc. I submit table No. 2 which shows a comparison looking at the figures from a little different standpoint:

TABLE NO. 2.

Showing difference in average time, car miles, and work done using the same factor in each case.

	Compound 66.	Ordinary Engine 107.	Per cent. for ordinary	Per cent. against ordinary.
Actual running time	9:32	7:50	.217	....
Cars in train	14½	15½	6.98	....
Cars per mile	1,691	1,809	6.98	....
Pounds of fuel used	12,015	13,583	....	13
Pounds of coal per car mile	7.1	7.4	4.2	....

These figures show that the compound did not do as well as the ordinary, even if the report of coal used is correct, if we assume that the 15⅛ cars drew as hard per car as the 14⅛ did for the compound.

Without further criticism of this test I would again say that I have not seen any reported tests of compound engines as against the ordinary engines "which convey to my mind just how these experiments are conducted." In my former communication I did not mention that the data collected should include a graphic record by an instrument which would show the speed at all times and the amount of power constantly being expended to draw the train as I supposed that at this late day most of the railroads had a test car, which would furnish this and similar data. In fact what we want is a knowledge of all the facts in the case. F. M. WILDER.

A Conductor's Plea for the Duplex.

PHILADEPHIA, Sept. 22, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Among the essentials to the evolution of a thoroughly good and reliable conductor are a strong character and even temper. He should be courteous, kind, patient, forbearing and firm. Patient in the face of unreasoning complaint and suspicion; forbearing under the provocation and insult which he receives almost daily from intoxicated passengers and rowdies; and firm whenever the proper enforcement of the rules requires him to be. Above all things, he should possess the confidence and respect of his superiors.

The conductor who takes out his train feeling that his efforts to run it profitably and safely will be appreciated by those in authority over him is a far better and safer man to be charged with the safety of human lives than one who is told to go on this train or that train in a cold, arrogant manner. Can a man who is kept constantly in fear of discharge for trivial matters give that cool, unflagging care and attention to his duties that can be given by one who is not so situated?

There is a feeling among the officers of some railroads that their conductors are not always as honest as they should be; but are not the managements themselves often largely responsible for such a condition of affairs? Think of a conductor who is placed in charge of a train on a road which has no duplex system to protect him from the insinuating remarks of reluctant excess-paying passengers, the lying tongues of spotters and the apparent distrust of its officers. If all roads would adopt the duplex system and authorize their conductors to charge a small sum in addition to the regular rate, to be refunded upon presentation of the duplex by the passenger at any ticket-office, the feeling of distrust between the passenger and the conductor, and the officers and the conductor, would be speedily done away with.

For want of some such system as this, many a good, competent conductor is unfit to have charge of a train. He thinks that every passenger from whom he has to collect a fare is a "spotter;" constant wrangling with heated passengers over rates and the numerous resulting complaints and reprimands from his superiors render him moody and forgetful of other things; forgetful, alas! sometimes, that he has lives in his care whose safety should engross his every thought.

If these views are well founded it follows that a conductor's capability and reliability depend almost as largely upon his environment as upon character and temper. CONDUCTOR.

[An ironical maxim says that "honest men will bear watching." The above letter calls attention to the more precisely truthful statement of the same idea, or a part of it, that an honest man who handles money for others is not only willing but desirous that all proper safeguards shall be employed to obviate the possibility of injustice to *either* party. The bank cashier whose cash is all right not only is willing to have the examiner appear at his door but heartily welcomes every such opportunity to get outside testimony to his faithfulness and the accuracy of his work. It would be well if all honest conductors were more enthusiastic in propagating the ideas of our correspondent. Every one knows that some individual is liable at any time to yield to the temptation to steal cash fares, and it is a duty to establish as strong a contrast as possible between the spirit and methods of those who do steal and those who do not.—EDITOR RAILROAD GAZETTE.]

The Block System on the Erie.

Readers of the *Railroad Gazette* will recollect that the New York, Pennsylvania & Ohio has recently improved the dispatching system on its third division (Kent to Galion, O., 93 miles) by the establishment of rules that practically put in effect a block system for all trains in both directions. As this division is all single track and is a busy road, with stations not very close together, this experiment is of special interest. Most of the single track blocking that is now in force on American roads, and that has heretofore been described in these columns, is either on much shorter pieces of road or is enforced only where the traffic is usually lighter than here. The blocking on the "Nypano," moreover, is not now an experiment, having been operated for two months with great satisfaction, and as the details are in some respects different from those found in the practice of other roads we present herewith a sample train sheet and a copy of the rules under which the system is worked.

It will be seen that the prominent feature is the placing of practically all the work upon the dispatcher, no station operator ever giving either absolute or conditional permission to a train to proceed except upon an order from the dispatcher's office. The operator has no more difficult work to do than before, but as he must get a communication from the dispatcher for every train he has *more* work to do. The fixed signal at the stations is a semaphore (arms for both directions on the same post), made to show three positions, that for "caution" being shown by throwing the arm up from the horizontal position. It may be mentioned incidentally that every station office is provided with Mozier's cutting-out device, described in the *Railroad Gazette* of Jan. 3, 1890, which makes it impossible for an operator to open his key while his train-signal is in the clear position, thus insuring that he will neither answer a call nor give OK to an order except when the signal is in position to stop trains.

The train sheet is self-explanatory. It shows about one-tenth of a day's work on 34 miles, there being four first-class trains and from 15 to 20 freights each way daily. The code of rules needs little explanation. Rule 6 leaves upon the conductor and engineman, as before, the responsibility of avoiding trains of superior right from the opposite direction; although in the usual course the dispatcher, of course, guards both ways before giving a signal. Under the last sentence of rule 9 the dispatcher sometimes gives an order for two or three sections at once, as for instance, "1st, 2d and 3d, 90, left . . at ....: give white to first and green to second and third."

Rule 11 is to provide for such places as that shown in the

sketch. If a train, moving in the direction of the arrow, pulls into the sidetrack as far as *d* to wait for a faster train, it must not move out through the switch *C* to follow the fast train except upon the order of the operator at *A* as given by the semaphore; and if the distance is too great for the signal to be seen, the conductor must remain back far enough to get positive information as to its position before he starts the train.

The advantages of this system have not been secured without some cost, the number of dispatchers and of station operators having been increased. Three dispatchers (eight hours each) and two operators (12 hours each) formerly handled the trains on the whole division, 33 stations, 92 miles, issuing 100 to 125 orders a day. This force has been doubled, and each set of five men, as above, handles about half the orders. The schedule here given shows the length controlled by one dispatcher at a time. It is only 34 miles long, but the work of the 92-mile division is about evenly divided, the other portion having less local and yard work to hinder trains. The number of orders now issued is 30 to 50 per cent. greater than before, an average day selected at random showing 79 + 76 = 155 orders on the two subdivisions. Of these 110 were meeting orders. It will be understood that the orders to change signals are not numbered, being recorded only by the letters (G, W or R) on the train

sheet. Night operators were put on at nine stations which had formerly been day offices and six new offices were put in to make the blocks of more convenient length. These offices are established in frame towers of the usual style. The company will probably adopt the block system on the second division, Meadville, Pa., to Kent, O., 88 miles, within a short time.

NEW YORK, LAKE ERIE & WESTERN RAILROAD CO.,
N. Y., P. & O. R. R. Third Division.

BLOCK SYSTEM RULES.

[Copyright 1891 by A. M. Mozier.]

The section of road between each station will be known as a block, and each station shown on the time table will be known as a block station.

1. The train order signals will be used to govern the operation of the block system as well as for stopping trains when there are orders for them, the right hand arm of signal governing trains as they approach it.

2. When the arm of the signal stands in horizontal position, (thus —) it signifies danger, and requires that an approaching train shall stop before passing it. When the signal arm is elevated to an inclined position of 60 degrees, thus (/), it signifies caution, and indicates that the train may proceed under control, keeping a sharp lookout for preceding trains, or trains that may be at work between the block stations. When the signal arm is depressed to an angle of 60 degrees, thus (\), it indicates safety, and the train may proceed, provided it can reach the next station without encroaching upon the time of a train of superior rights.

3. The several positions of train order signals, described in Rule 2, will be indicated at night by different colored lights at top of the signal posts, *Red* signifying *Danger, Stop; Green* signifying *Caution*, proceed with care; and *White* signifying *Safety*, no train on the block.

4. No train or engine shall be allowed to enter a block while occupied by another train, except that second class trains and extra freight trains, running in the same direction, may, under direction of the train dispatcher, be allowed to follow each other five minutes apart under *green* block. Passenger trains, following freight trains, may be allowed, under direction of the train dispatcher, to follow, under *green* block, ten minutes behind such freight trains.

5. No train shall be allowed to enter a block while it is occupied by a passenger train.

6. Exceptions to the foregoing rules will only be made in case of interruption of telegraph communication, so that instructions cannot be received from the train dispatcher, in which case the operator at a block station will hold all trains ten minutes apart and only allow them to proceed under green or caution signal. He must, however, if possible, first ascertain from the operator at the next block station that no opposing train is on the block, and arrange with him to hold any that may approach.

7. The signal at block stations must be kept in the danger position at all times, and never raised to the caution position or lowered to the safety position until so ordered by the train dispatcher (except as provided in rule 6), and then only to allow the train to pass, for which authority has been given by the train dispatcher, and for which there are no special orders.

8. Operators at block stations will report as early as possible the approach of each train, except when special orders are awaiting the train, using the numeral 72 when necessary to take the circuit; and if practicable obtain instructions from the train dispatcher as to signal that shall be given without stopping the train. They must also report the departure of trains promptly; but a train must not be reported as having left a station until the rear end has passed 300 ft. beyond the train order signal. Operators must carefully observe the rear end of all trains to see if the customary markers are displayed, and if not, they must report the fact at once to the train dispatcher.

9. When an operator reports the approach of a train, the train dispatcher will give instructions as to which signal shall be displayed, the following form being used: The operator will report "No.—coming," when the train dispatcher will reply "red," "green" or "white" as the circumstances may require, signing his initials. The operator will then repeat this signal back to the train dispatcher, signing his own letter and office call, and display the signal as ordered. Train dispatchers will, however, when practicable, give instructions in advance as to signal that shall be displayed, and such instructions must be repeated back by the operator.

10. When a train is stopped by the danger signal, the conductor and engineman must go at once to the telegraph office to reply to such orders as may be awaiting the train. If there are no orders for the train they will be given a clearance, on blanks provided for that purpose, but the train *must not proceed* until the *caution* or *safety* signal is exhibited, which will be done by the express direction of the Train Dispatcher, except as provided by rule 6—*no train being allowed to leave a station while the signal is at danger.*

11. At meeting or passing points where it is necessary for trains to pass the danger signal to pull into side track or to let other trains pull out of side track, they may do so, but as soon as the track is clear they must be governed by the requirements of Rule No. 10.

12. When more than one train has passed the signal while in the danger position to take side track or to allow other trains to leave the side track, as provided for in rule 11, the displaying of the safety, or caution signal will only allow the *leading train* to proceed, and after the departure of such leading train the signal must be returned to the danger position until such time as the train dispatcher shall authorize the display of the safety or caution signal to permit a second train to leave, and so on until each train shall have been given the caution or safety signal, separately, authorizing it to proceed.

It must be distinctly understood that the foregoing block signal rules are not to be construed as affecting the rights of any train under the time table or train rules; nor do they relieve trainmen from adopting all the precautions for protecting their trains that are required by the train rules.

. . . Rule 524 is annulled on the above division of the road, so far as it conflicts with these rules.

NEW YORK, LAKE ERIE & WESTERN RAILROAD CO.
N. Y., P. & O. R. R. Third Division.
....., 189.. Time Table, No. .....
TELEGRAPH REGISTER OF TRAINS.

EASTWARD.					WESTWARD.		
Go	Go	17		No. OF TRAIN.	1	Extra	3 of
Keiker / Flueau.	Dainon / Hall Walker	Harne / Marrion		CONDUCTOR AND ENGINEER	Audrey / Daughs	Sweeny / Logan	Columbus / Stewartt
600	16/169	3 77		No. of ENGINE.	301	197	144
32 Cars. / Pass	51 mchp / P.M.	9 Cars. / Am		No. OF CARS IN TRAIN.	9 Cars / Am	18 Cars / Am	10 / Am
900 ℄	801 ℄	838 G.	KD	Kent,	702 W.	647 W	647 ℄
847 W	745 W	830 W	GE 5.9 Tallmadge,	709 W	657 ℄	657 ℄	
837 W	770 R/	829 W		709 W.	657 ℄	831 ℄	
816 ℄	701 ℄	814 W	AK 4.5 Akron,	721 W	710 ℄	848 ℄	
727 ℄	655 ℄	813 W		723 W	720 W.	858 ℄	
709 W	640 W	807 W	PE 6.1 New Portage,	736 W	755 W	917 R	
659 W	640 W	806 W		737 W.	853 W.	937 ℄	
648 W	676 W	800 W	SM 3.9 Sherman,	746 W	1009 R	945 ℄	
648 W	615 R/	800 W		747 W	1013 ℄	947 ℄	
627 ℄	608 W	757 W	SC 2.3 Silver Creek,	753 W	1027 ℄	1009 ℄	
608 R/	558 R/	750 W		759 W	1033 ℄	1070 ℄	
600 ℄	550 ℄	748 W	RS 1.3 Wadsworth,	801 W	1057 R	1045 R	
600 ℄	550 ℄	747 W		803 W	1105 W	1051 W	
545 ℄	536 W	739 W	MO 4.7 Rittman,	811 W	1115 ℄	1058 W	
545 ℄	536 W	739 W		811 W	1124 ℄	1100 W.	
536 ℄	527 W	734 W	RU 3.7 Sterling,	817 W	1139 ℄	1111 W	
529 ℄	520 W	729 W.		820 W	1145 ℄	1144 W	
520 ℄ pm. R	510 W Pm R	723 W Am R	SE 2.5 Creston,	824 W Am	1230 ℄ pm	1150 W Am	

NOTE.—*G* indicates that a green signal was given; *W* white, *R* red. The large number of green signals at Akron is on account of a switching engine that occupies the main track there much of the time. Additional block offices have been put in at Kent and at Akron (at the west end of the yard in each case) which had not been printed in the train sheet when this blank was filled out.

The Rapid Transit Question in New York City.

The four experts chosen to consider the plans reported to the Rapid Transit Commissioners by Mr. Worthen and Mr. Parsons, have handed in their reports, and these are now under consideration by that Commission. A conclusion will probably be reached in a few days, but how soon we have no means of knowing. Meanwhile we shall give at considerable length the plans laid down by Messrs. Worthen and Parsons, and the comments upon these plans, and further suggestions made by the engineers who examined them. It is hardly necessary to apologize for the amount of space that we devote to this matter, for it is an engineering problem of the first magnitude. The routes were selected by the Rapid Transit Commissioners, and we have already published them. Messrs. Parsons and Worthen, therefore, had before them only the question of how best to meet the requirements of construction and travel along these chosen routes. We give below extracts from the reports made by these engineers, which have already been published in outline, and follow with the reports of the experts. We take the liberty of departing from the language of the writers of all these reports, whenever it is convenient to do so, but shall endeavor to retain the logic and sense of all the reports.

REPORT OF MR. WILLIAM E. WORTAEN.

I would commence with a single loop track at Battery Park, forming a double track from just north of Beaver street up the east side of Broadway to City Hall, thence by a four-track line to the terminus at Spuyten Duyvil. The loop will admit of one minute headway between trains and will afford seating capacity much beyond that of the elevated roads.

The construction consists essentially of a tight plate iron cover supported by wrought iron girders and posts with a concrete base. Above the plate iron a preparation of coal tar will be injected to secure tightness and preserve the iron. The present pipes, pavements and structures will be left intact.

The roof of the railroad will be 7 ft. 9 in. below the curb, avoiding all existing pipes, giving headroom beneath the sidewalk and above the outside or local tracks for access to the central tracks. It is desirable that the excavations should not be below the foundations of present buildings. This is secured with regard to new buildings and most of those which may be considered fairly permanent.

The cars are 8 ft. 6 in. wide by 8 ft. high over all. They have no monitor decks. The lengthand capacity are the same as those of the present elevated roads, although the end platforms may be removed and central openings provided. The station platforms are 320 ft. long, allowing trains to be run with 350 seats. The platforms can be readily lengthened when the traffic requires.

From Fifty-ninth street to Spuyten Duyvil it is proposed to use an open cut, except when the 1 per cent. grade compels the use of a tunnel or viaduct.

Construction.—The method of construction is briefly as follows: The great principle is that there should be no disturbance of the surface of the street. Beneath the sidewalk and street on the east side of Broadway "poling boards" are driven outward from the walls. The earth is taken from beneath the poling boards and deposited in the vaults, to be removed by hoists, at night. This construction obtains throughout. The work is to be carried on day and night, and all material removed at night. Above the City Hall, where the road is four tracks wide, at every station, say five squares, the poling boards are driven from each side to the centre of the street, but at such a height that the shields can be put beneath them and operated lengthwise of the street.

It is not proposed to deposit all the earth from the excavation in the vaults, but to take out sufficient to make room for tracks, and to carry away the rest by cars.

The apparatus for tunneling may be described somewhat more at length as follows: It is intended for the case where there are two parallel walls already built which form the sides of the tunnel. The roof of the tunnel is to be composed of iron beams extending across and covered by plates. The plates extend across the tunnel and are wide enough to reach from centre to centre of the beams. The ends of the beams are to rest on the walls, and their centres to be supported by a longitudinal row of iron columns. The apparatus for excavation consists of horizontal sheet piles or "needles," or, as Mr. Worthen calls them, "poling boards," each composed of two parallel channels, set on edge, covered by a 12 in. by ½ in. plate, riveted to the upper flanges. The upper side and edge of the plate and the lower side of the channel are to be planed. These pieces are placed side by side close together, lengthwise of the tunnel. A guide is provided to direct and support the forward ends of the needles. It consists of a broad steel or iron plate lying nearly horizontal, extending in one or two pieces nearly across the tunnel, having at intervals of 12 in. upright partitions made of 15-in. I-beams riveted to it so as to receive the channels of the needles. The guide is provided with set screws to adjust its inclination. The needles are supported near their rear ends by struts resting upon sills. These struts are capped by a box girder. The needles are driven forward longitudinally into the earth closely followed by the guide. The material included in their cells is taken out, and the face of the heading below the guide is kept back far enough and with a sufficient slope to form a support for the guide at all times. When all of the needles have been moved forward 13 in. the supporting struts and girders will be moved out. Preceding each movement of the apparatus one roof beam and plate will be put in place under the cover plates of the needles, which project sufficiently to the rear. The same method is to be used when practicable by working out transversely from the vaults.

REPORT OF MR. WM. BARCLAY PARSONS, C. E.

The ideal construction along the Broadway line would be close to the surface, that the cars may be reached with the fewest number of steps. The cost of this construction would also be a minimum, as the excavation would be shallow and foundations would be little interfered with. But the space immediately under the surface of Broadway is occupied for from 8 to 10 feet with pipes and wires, and below that, to a depth of about 13 feet, is the street sewer. The question arises, then, if a railroad can be so constructed as not to interfere with these pipes and wires.

Rock Tunnel.—This might be done by a solid rock tunnel with elevators, or by a tunnel between the rock and the surface driven by means of a shield, through the sand. Borings made by the engineers of the Commission show that between the Battery and 30th street the rock lies at depths of from 13 ft. to 163 ft. below the furface. At many places it is more than 100 ft. down. But in order to clear the deepest depression, viz., 163 ft., and to have a sound roof the rock tunnel will have to go to a depth of 200 ft. or more. This would be practically impossible for the purposes under consideration.

Shallow Tunnel.—A tunnel through the sand could be driven at any desired depth, but the cost would be excessive and the risks great. The results of the borings made show that for a considerable distance along Broad-

way, and especially where the buildings are largest and the traffic greatest, the underlying sand is very near, if not actually, quicksand. Above the tunnel would be the water mains and sewers. It would be impossible to avoid such settlement as to spring leaks in these, and as a result the sand would be charged with water, would flow more freely, and still further settlement would follow. With the weight of the enormous buildings alongside the line of Broadway and the constant jar from the heavy and steady traffic the peril of very great and costly accidents from the movement of this fine sand would be always present. From Twelfth street on, the tunnel would have to be driven partly through rock, partly through sand.

Plan Proposed.—Therefore, having in view the cost and risk of the deep rock tunnel, and of the intermediate shield tunnel a plan is presented which keeps the proposed structure close to the surface of the street, embodying the great advantage of easy access to the railroad, of disposing permanently of the pipes and conduits, and of presenting a plan, the cost and risk of which can be estimated with great accuracy beforehand. This plan is a structure to carry four tracks, set in pairs close to the curb line, one track above the other, the upper one for local trains, the lower one for express trains, with a gallery or chamber between them to carry the pipes and wires.

It is aimed to keep the railroad between the curb lines except where it is necessary to encroach upon the vault space at stations. A careful examination of Broadway discloses the fact that from the Battery to 34th street it is very irregular in width; in one place it is 34 ft. 4 in. between curbs, another 37 ft. 5 in., another 39 ft. From Fulton to Canal street 42 ft. can be had by encroaching a few inches on the sidewalks near Duane street. From Canal street to 25th, 44 ft. can be had by encroaching a little on the sidewalk between 18th and 21st. Above 25th street, 40 feet in the clear can be had. A list of water mains and gas pipes for which provision would have to be made in the central chamber is given.

The question of dealing with the sewers is a simple one. The longest sewer in the street is one of five blocks from Spring to Canal street, and the few cross sewers can be easily dealt with. All that would be required on Broadway would be small pipes carrying the sewage of abutting houses, which could be turned to the right or left down the cross streets.

Equipment.—It is not proposed to run standard passenger coaches. The regular trains will be so frequent that it would not be possible to interpolate trains of any other road, or, if possible, it would be inadvisable. The motive power should be competent to haul the trains at 40 miles an hour up 1 per cent. grades, and the cars should be made light. It is found on investigation quite possible to construct a car of steel or wood that can be run conveniently in a tunnel but 10 ft. high, whereas an ordinary passenger coach would require 14 ft. 10 in. For the double structure proposed the total saving in height could therefore be 9 ft. 8 in., decreasing the cost and bringing the level of the car floor closer to the street surface. A saving in width of 1 ft. 2 in. per track may be made by using a car of the elevated railroad pattern instead of a coach of standard width, which permits widening the pipe chamber 2 ft. and 4 in. The only inconvenience in the interruption of the standard size of cars would be that passengers arriving at the Grand Central Station would be obliged to change, but these passengers would be so small a percentage of the total travel that it would not be justifiable to proportion the tunnels to suit their convenience. This is especially true as tunnels of such height as to take cars of standard dimensions would necessitate all travelers ascending or descending from 6 to 12 extra steps. The width and height of car proposed would be the same as on the elevated railroads. The ordinary platform space would be thrown into the inside of the car, the cars would be vestibuled together and have entrance doors on either side near the ends, so that one man could attend to two cars. It must be noted, however, that the use of the low car is not an essential feature of this plan.

Grades and Stations.—It is proposed to construct the railroad with a ruling grade of 1 per cent. The stations should, so far as practicable, be put at the summits of the grades. This will materially increase the running speed of trains, as the energy of the moving train will be absorbed going up the grade to the station, and speed can be got up quicker going down grade on leaving the station.

Provision for Pipes.—These may be placed with respect to the railroad above, below, at the sides or in the middle. The first is objectionable, because it would lower the level of the tracks about 10 ft. beyond what is necessary. If below, the pipes would be difficult of access, especially where the line would carry them below high water. There is not room in Broadway to put the pipes in vertical galleries at the sides of the railroad; and moreover it would be inconvenient disposing of them at stations. Therefore it is proposed to place them between the tracks.

Plan of Structure.—The plan of construction is to have the tracks next the curb line in a double tier—upper tracks for local service, lower ones for express service; The space between the upper tracks and immediately below the cable railroad to be used for pipes and wires. The distance from the street to the floor line of the upper cars is 11 ft., and to the floor line of the lower cars 22 ft. 4 in. This will require 19 steps to reach the cars on the way tracks and 38 for the express tracks, or 17 and 34 steps, respectively, if the same risers are used as on the present elevated steps. The stations would be entered by commodious flights from the ground floor of buildings, purchased for the purpose, and the station platforms would be built immediately under the sidewalks, about 20 ft. wide. The tunnel would be 12 ft. in the clear, the cars 8 ft. 8 in. wide over all. The tracks would be arranged to leave a clear space of 6 or 8 in. between the cars and the outside wall and 2 ft. 8 in. between the cars and the wall next to the buildings. This would leave room for trackmen, etc. Immediately beneath this walk the small sewer would be placed. The details of making connections with the pipes in the gallery have been somewhat carefully considered. This can be done above the car space of the local or upper tracks between the cross girders. Provision is also made for manholes by which to enter the pipe gallery and for getting pipes in and out. The street surface or roof of the tunnels would be composed of buckle plates of iron carrying a bed of asphalt concrete and sand, on which would rest the paving stones.

It is supposed that before reaching Canal street it would be found better to move the local tracks outward, narrow the pipe gallery as much as possible and bring up the express tracks so as to have the four on the same level, which would diminish the amount of excavation below high water mark. After passing this depression the normal arrangement could be resumed.

Above Fifty-ninth street the Boulevard has a width of 150 ft., with a central Parkway of 22 ft. It is suggested to construct the railroad in double tiers immediately adjoining the curb line of the Parkway, locating the station buildings in the Parkway itself. In this region the pipes and sewers are on the sides of the streets and would not be interfered with.

Advantages.—Some of the advantages of the double-deck construction are: The local tracks are close to the surface, to reach the express tracks fewer steps are required than if one had to go below the local track and up again. No divergence in the line is necessary. Express stations can be put in at any time without inconvenience. The arrangement is convenient for connecting with branch lines, as by lowering the express track on one side and passing the other two tracks between it and the local track above it, the junction may be made without crossing at grade. Yet the stations might be made double, so that in case of accident on the local track service can be maintained as local on the express lines, or when express is suspended those tracks can be used for freight or other purposes.

Ventilation.—It is only necessary to provide for the purifying of the air from fouling by passengers, and air ducts would be arranged at proper points leading from both tunnels, connecting with shafts supplied with fans. At other suitable points would be similar ducts and shafts without fans. Thus by exhausting at the first ducts fresh air would flow in at the others. The movement of the trains themselves would materially assist in maintaining such a current. Without going very far into this matter, Mr. Parsons is confident that ventilation could be easily secured.

Loads, etc.—The following loads and specifications are assumed: Beneath the sidewalk and the track space 1,500 lbs. per sq. ft., over the pipe gallery 1,000 lbs. per sq. ft., including in both cases the weight of structure. These assumptions are believed to be sufficient to withstand the shock of the fall of an abutting building. The unit strains assumed are 10,000 lbs. on wrought iron, 12,000 lbs. on steel. The weight on the track is assumed at 4,000 lbs. per lineal foot. "Z" columns are used in the plans.

Construction.—One method of construction suggested is to take one side of the street at a time, build the side wall in a narrow trench of 12 ft., put in the foundation of concrete and the track structure, slip across the beams underneath the cable road yokes, meanwhile holding the sand filling in the centre of the street by planks supporting the side walls. Buckle plates could then be put in and the paving put down, and one side finished before the other is begun.

REPORT OF MR. THEODORE COOPER, C. E.

Considering the breadth of his instructions from the Commission Mr. Cooper feels at liberty not only to examine the plans of Messrs. Worthen and Parsons but to suggest modifications. He approves of neither of them in their entirety, but agrees with Mr. Worthen that a two-track road will be ample below the City Hall. Relatively the capacity of these tracks will be greater than of the four tracks above. The undoubted existence of more or less treacherous quicksands over most of this part of the route is a great reason for restricting the tracks to a minimum.

Criticisms.—It is not thought well to bring the iron covering of the tunnel in direct contact with the material of the street above, more or less saturated with corroding liquids, nor is it thought possible to protect such iron surfaces from corrosion by injecting any kind of metal preservative.

The pole system of tunneling proposed by Mr. Worthen is not approved on account of the impossibility of protecting the iron covering from corrosion, and also on account of the risks involved. But the arrangement of the four track double tiers as suggested by Mr. Parsons is considered well adapted to some parts of the road. The central gallery for pipes, and the admission of sewer pipes into the track tunnels are both disapproved. Provision for pipeways should be considered entirely independently of the railroad system. Gas pipes should be carried in a special conduit near the surface, for 10 to 15 per cent. of gas in the air in the tunnel would make an explosive mixture which would be liable to be fired, with appalling results, by an electric spark from the motors. The sewer pipes would be objectionable because of possible leakage and fouling.

On neither plan is suitable provision made for cross-overs or side tracks. Mr. Parsons' central gallery cuts off such communications, and in Mr. Worthen's plan communication between the outer tracks would be difficult. But it is considered essential for the successful operation of the road that there should be suitable cross-overs and also middle standing tracks.

Mr. Parsons' plan has the merit of finally disposing of the pipes and provides a satisfactory means of protecting the covering of his tunnels by concrete, but the great injury to the business interests of the city in opening up Broadway in the manner proposed and the risks of excavating to considerable depth over so long a route make it desirable to employ some other method of construction. Moreover, neither plan provides sufficient room for track repairs and maintenance or for the safety of trackmen. Four feet clear of the car body at least should be given.

The vertical depth in both plans has been reduced by using extraordinarily low cars, but such a departure from tried and approved forms is risky. The low trucks would be difficult of access for inspection and repairs. This is a matter of great importance, especially on a system worked up to its full capacity. The monitor roof is an essential feature in the ventilation of any car. There will be just as much need for the proper ventilation of a car as if it were in the open air.

Plan Proposed.—Mr. Cooper therefore proposes, from the Post Office to the Battery, a double track line, forming a loop at the Battery, with provisions there for the necessary additional tracks; these two tracks to be on the same level, with a central platform at stations; and below all pipes and conduits. Above the Post-Office, under City Hall Park, there are one or more central standing tracks with cross-overs, so that trains may be stopped or started here or run around the Battery loop. All of this part of the line is to be used in common by local and express trains. Above the City Hall Park yard are four tracks, two express and two local. The inner tracks would be gradually dropped and the outer tracks gradually drawn together into the double tier form suggested by Mr. Parsons. They would continue in this way until it should be necessary to bring them again to a common level under Canal street, above which they would again take the double tier form to near Twelfth street. At this point the four tracks are again spread to one level and dip down to solid rock with a rock roof. This continues up Broadway to somewhere near Forty-sixth street, when the tracks can be brought up near the street grade until they emerge to cross viaducts near 125th street. It would be well to cross the Harlem at such height as to avoid the necessity for opening a draw-bridge.

Construction.—It is proposed to construct the line from the Battery to near Twelfth street by the use of some modification of the Beach shield. We do not discover how far below the surface Mr. Cooper would go with this part of his line, but above Fourteenth street he would expect to be able to keep a rock roof of 6 or 8 ft., with the level of the station platform not more than from 25 to 40 ft. below street grade. From Thirteenth to Forty-sixth street but four or five stations would be needed. Therefore by going down into solid rock and using elevators the minimum cost of construction could be had. Above Forty-sixth street Mr. Cooper would bring the tunnel near the surface.

The main difficulties being below Forty-sixth street he has devoted his devoted his attention mostly to that part of the line, and as no plans, surveys or data have been presented for the east side line he makes no suggestion for that route. It may be best to use some other cross-section than a circle, but with a circular section of about 16 ft. diameter for each track plenty of room would be had for cars of the size now used on the elevated roads and still leave room for trackmen.

REPORT OF MR. JOHN BOGART.

Mr. Bogart says that the method proposed by Mr. Worthen does not interfere with existing pipes and subways, and notes that should it be necessary in the future to provide galleries for these pipes they could be constructed adjacent to each curb line and above the roof of the railroad, but he does not consider it necessary under the law to make provision now for anything other than the railroad. The plan submitted by Mr. Worthen is the more economical in immediate construction, and should it be deemed proper eventually to provide for the pipes and conduits they can be placed as suggested by Mr. Worthen, so as to be readily accessible from the basements or the sidewalks. The floor of such a gallery, over the roof of a depressed railroad, can be tight and not excessively loaded.

The requirements for express and way trains are complied with by both systems, but the transfer would be more easily accomplished from local to express, or vice versa, by the Worthen plan. By the Worthen plan, also

the surface is not interfered with during construction.

The question of the probability of successfully carrying a tunnel through the material directly underneath the pipes and subways without endangering their stability and the stability of pavements and foundations is the most serious one to be considered. Mr. Bogart is assured, however, by persons of large experience in tunnel and sewer construction that this can be done, and it is his opinion that a tunnel excavation at the depth proposed by Mr. Worthen, viz., 7 ft. 9 in. below the surface, can be carried on without danger to the pavements or pipes. He does not consider that there is danger to the foundations of houses and structures under either plan.

REPORT OF MR. O. CHANUTE, C. E.

The engineering problem submitted is so complex that it does not permit of arriving at the best solution by the exclusive adoption of any one general plan. The designs of the engineers will need to be both combined and departed from, not only in order to meet the local requirements, but also to promote efficiency in the subsequent operation of the roads.

General Conditions to Be Met.—The underground lines will be subject to the following among other operating necessities:

They must be divided into operating sections to apportion the train service according to the density of the traffic. They must have connecting tracks and switches. Long sidings will be required for spare cars and motors. There must be shops for the rolling stock and storage yards for track material. There must be room in the tunnels for employés to make repairs without danger to the trains or to themselves.

The discussion of these requirements and the means of meeting them will be simplified by dividing the lines into five sections, according to their characteristics and requirements, as follows:

1. Battery to Union Square; sand formation, very dense traffic and very many complications.
2. Union Square to south end of Central Park; chiefly rock near surface, dense traffic.
3. Central Park to Manhattanville on west line, to Harlem on the east line; chiefly rock, considerable traffic.
4. Manhattanville to 181st street on west line, Harlem to Morrisania on east line; chiefly rock, traffic comparatively light.
5. Above limits to city limits; open country.

The features of construction of each of these sections will be separately discussed.

1. *Battery to Union Square.*—From the Battery to Union square, although but about one-tenth of the proposed line, is the most important and most complicated. The engineering difficulties and the risk of disaster, the narrow limits, dense traffic, and complication of underground pipes and varied interests to be protected, appeal to the imagination and inspire the hope that some one design can be invented which will solve all the questions. There is probably no such design possible except the old and well-tried plan of varying the design and the construction with the varying requirements of the case.

The construction on this section will be almost wholly through sand, some of it approaching quicksand in character. At South street the surface is 4 ft. above tide, at Beaver street 15, at Canal street 10. At these points the construction will necessarily be below tide water, and the difficulty of making it water tight will increase rapidly with every added foot of hydraulic head. Were there no other difficulties it would be advisable to have the four tracks on a level.

Mr. Chanute then considers the restricted width of Broadway, which has been pointed out in the preceding reports. With four tracks on a level, every vault would probably be cut into from the Battery to Cortlandt street, and from there up to Union square over 40 vaults would be cut. This part of the difficulty is lessened by the double-deck tunnel plan; but even by this certain vaults would be cut.

The suggestion for a pipe chamber is a good one, but there is liability to flooding the lower tracks by leaks, and no provision is made for drainage. Mr. Chanute suggests that the pipe chamber be made narrower and carried down to the bottom of the lower tracks.

The design for placing the four tracks on a level avoids the complications of pipes by driving a roof shield below them at a proposed depth 7 ft. 9 in. below the curb, but some of the pipes are actually 11 and even 12 ft. below the surface. Although the lowest of these could be raised, it is likely that the top of the four-track tunnel shield will have to be at least 9½ ft. below the surface, and the total depth would be 22 ft., instead of 20, below the curb, with no provision for drainage at the bottom.

Danger of the Roof Shield Method of Tunneling.—The weakest point about this plan is the proposed method of excavation. This is explained in the abstract of Mr. Worthen's report. In clay or firm soil this has given good results, but it is inappropriate to sand as fine as is known to be frequently found on this section. There would be danger of disaster. There would be sure to be wet sections from leaky pipes or from pipes broken during the excavation. The fine sand would run away like water from under the temporary posts and the whole street, as well as some of the adjoining buildings, might cave in. No provision is shown for counteracting the side thrust. The vault walls are not deep enough or strong enough for this. In this section there are not less than 270 foundations which go less than 15 ft. deep, while some of the house foundations are only 4 ft. deep, and those of Trinity Church 9 ft. 4 in. on the Broadway side. The risk of tunneling through this sand with a roof shield would be too great and the difficulties too formidable. The street must be attacked with an inclosed shield or from the top.

It is most desirable that the work should be carried on if possible, without disturbing the surface of the street anywhere and without interference with its traffic, but I doubt whether it can be accomplished throughout within limits of cost which will not prove prohibitory. It may be done through certain parts, but over a considerable part of the line a certain amount of interference with the street traffic, by tearing up the pavement, will be part of the price which the public will have to pay to secure underground rapid transit. Such present interference with traffic will be much more than repaid in future years, if a pipe chamber be provided now, by the permanent relief of the necessity for tearing up the pavement in order to lay down new pipes or to repair old ones.

The use of enclosed shields will not only be costly through wet sand and boulders, but ill-adapted for connecting tracks and sidings, so that it seems probable that on much of the line methods will need to be used by which building foundations have been put in and carried down as deep as 30 ft.

The following are the various designs of construction which, with my present knowledge, seem to me most appropriate to the various portions of the section between the Battery and Union square.

From the Battery to Beaver street, I believe that the design of Mr. Worthen for a single track loop line, without pipe chamber, is the preferable one to adopt. It goes down to a depth of but 13 ft. 6 in. under the sidewalk; it covers but a length of 1,300 to 1,500 ft. and it can accommodate not only all the local trains, but also such of the express trains as it may be found advisable to run to the South Ferry.

Somewhere above Beaver street the two additional tracks may branch out, but, as I also approve of Mr. Worthen's design for a loop line around City Hall Park in order to connect with the Brooklyn Bridge and to enable the greater proportion of the express trains to reverse their direction without switching, I am not very clear whether it is best to introduce any stretch of double-decked structure below City Hall Park, or to keep all four tracks on a level.

By raising one pair of tracks from Beaver to Liberty street (1,700 ft. in length) a double-decked structure could be carried for 1,500 ft. from Liberty street to Park place, but it would probably interfere with arranging the loop tracks in such manner that no train should cross at grade the path of other trains going in an opposite direction. As the street widens between curbs, from 34 ft. 4 in. at Rector street to 50 ft. at Chambers street, four tracks in the same level would here interfere with the vaults but a portion of the way.

From City Hall Park to Clinton place my present judgment is that the road will best fit its surrounding conditions if designed as a double-decked structure as prepared by Mr. Parsons, but with a pipe chamber six or seven feet narrower and extending down to the lower tracks. It would be possible, within the limits of a 1 per cent. grade, to have a double-decked structure opposite Park place, and to bring all four tracks on a level at Lispenard street, in order to save depth at Canal street, but I believe I should prefer, if the latter location proves wet, to drive through it by means of closed shields and water-tight construction rather than to change the design of the structure.

The pipe chamber must be separately enclosed and ventilated to exclude gas from the tunnel.

From Clinton place to Union square, a distance of 1,600 ft., the preferable arrangement would be to bring the tracks gradually to the same level, partly to diminish cutting in the rock, which here comes up toward the surface, but chiefly to provide for the junction at Union square. At this point the four tracks from the lower part of the city are to branch out into four tracks on the east side lines and four on the west. To arrange for an interchange of trains and cars and yet to avoid that trains going in opposite directions shall cross each other's path at grade it is preferable that all four tracks shall be on a level at Fourteenth street, whence, by dividing them around Union square, raising one pair and depressing the other, they may be passed over and under the connecting tracks as proposed by Mr. Worthen.

A series of side tracks under Union square would much add to the convenience in operating, and it may also be suggested that a loop line under the walks in Madison square would permit many trains to be turned around bodily, and thus better apportion the train service to the volume of traffic.

2. *Union Square to Central Park.*—In the vicinity of Union square the material to be excavated changes completely in character; rock comes near the surface, and so continues to the upper part of the island on both projected lines. It is ragged and broken, full of pot holes and fissures, and further surveys are required before it can be determined how it is best to attack it. The character of the engineering problem is thus materially changed and the argument heretofore advanced that it would be unduly risky to rely upon obtaining a firm footing for the temporary struts sustaining an overhead shield is only meant to apply to the soft sand in lower Broadway.

Another important consideration against the use of the roof shield is this: There would be points where it would be too near to the dividing line between the earth filling and the rock, and the blasting just below the pipes and sewers would be exceedingly dangerous. But excavations from the top downward through the rock would be intolerably tedious. It is my impression that the preferable plan above Thirty second street would be to sink a series of shafts to the bottom of the desired excavation, and thence to tunnel and work up to the determined height, but before it can be known whether such a plan is feasible it is necessary to ascertain just where the rock is situated.

I believe the parties who undertake to build the lines above Union square would prefer to adopt the double-deck design up to about Thirty-fifth street, and above this to make four tracks on a level up to the south end of Central Park. Upon the east-side line the construction should preferably consist of a tunnel in the rock, for four tracks on a level under the existing street car tunnel on Park avenue, which is itself partly in rock. About Forty-second street Madison avenue is built upon the rock, and through this a tunnel of four tracks on a level can be carried as far as Central Park.

3. *Central Park to Manhattanville.*—From Fifty-ninth street north, on the west side, there is a wide boulevard, and the water pipes are said to be under the sidewalks. I believe the preferable design over this section would be that of placing the four tracks on the same level, just under the pavement, both to make them more accessible to the public and to avoid striking deep-seated springs which prove sometimes so troublesome. As far up as Manhattan street, I would suggest dividing the tracks into two roadways, one on each side of the central plot, and placing the station-houses on the latter, while providing connecting tracks and sidetracks at convenient points. On the east-side line it is best to drive a tunnel for four tracks on a level as far as Ninety-sixth street where the viaduct specified is to begin.

4. From Manhattanville to 181st street there are no trees or grass plots in the center of the Boulevard, and there is as yet very little street traffic. The four tracks on the same level may be brought close together in the centre of the street, spreading them apart where sidings are required, and providing also branch lines to private property upon the hillside, which is skirted by the Boulevard, so as to admit of surface sidings, loop tracks, storage yards and machine shops upon land to be purchased for such purposes. The work upon this section can be carried on from the surface downward without material interference with the street traffic.

5. North of 181st street, or of the Harlem River, the country is so broken and the present business is so thin, that the problem is reduced to that of building an ordinary surface line which shall be cheap enough to pay. The cost of the line as now located can be largely reduced by additional surveys, but, even then, it seems to be a question whether there is enough traffic now to warrant building the road, which will eventually be required.

Equipment.—Concerning rolling stock, I agree with the views presented to your Board by Mr. Parsons that ordinary passenger coaches need not be provided for; also that it is possible to construct cars which shall stand somewhat lower than the cars in standard use. Being apprehensive, however, that they might be rather cramped if designed to run in a tunnel 10 ft. high, I have assumed a minimum height of 10 ft. 6 in. in my estimates of the depths of the structures. I also agree that the cars should be closely vestibuled and shall be entered and left from the sides, as is the practice in Europe.

I also wish to commend the proposal of Mr. Parsons to locate gradients on the approaches to local stations wherever it is practicable to do so in order to assist the trains both in slowing up on arriving and in getting rapidly under way on departing. The tracks will have to be on metal supports, with some cushioning arrangements, and of massive proportions.

Mr. Chanute concludes by recapitulating his suggestions, and then calls attention again to the immense complexity of the problem, added to which the capitalists who may contemplate acquiring the franchise will inquire whether the problem has been solved in the most economical manner. He believes, therefore, that the Board will conclude to lay down its requirements only in a broad and general way and provide that the specific details should be approved or disapproved as the working plans are prepared. He concludes with the caution that there will be need of rigid specifications, for very much will depend upon the skill and care with which the work is conducted, and the average contractor, skilled only in surface operations, might fail when dealing with underground work and water. Latitude may be allowed in the designs, but there should be none in their strength and safety.

REPORT OF MR. JOSEPH M. WILSON, C. E.

The fact that the municipal council of Paris has lately voted in favor of a subterranean system of rapid-transit railroads strengthens your position, and the prejudice against underground service will be much modified by the use of electric motors with clean and bright surroundings. The lines laid down on your plans have been located with good judgment. The design adopted

should be that which allows the best facilities for connecting with branches, and connections should be made without grade crossings. The four-track level system proposed by Mr. Worthen is superior in this respect to the double-deck plan, as by it grade crossings may be avoided and the maximum depth to which the tracks are sunk be made from 8½ to 9 ft. less than with the double-deck plan. At the southern end of the line the considerable depth below high water reached by the double-deck system would render it desirable to change the type in this section to the four-track level system. Two tracks below City Hall, as suggested by Mr. Worthen, will probably be sufficient, and his provision for a loop at the City Hall, by which trains can be turned and connection be made with the west end of the Brooklyn Bridge, is excellent.

It appears that possession of the space now occupied by private vaults can be easily got by condemnation, and that the possession of these vaults is not now considered so valuable a franchise as formerly. Therefore the question of giving consideration to a partial use of these vaults does not appear very important. Above City Hall these need not be much disturbed.

More or less underpinning and strengthening of foundation walls will be needed in any case, and this question will require very careful study. Underpinning can, however, be successfully accomplished but it is attended with more or less risk, and is expensive. In this respect the four-track level system has an advantage of the double deck system in that it does not go to so great a depth.

It is not desirable that the question should be complicated by undertaking to deal with pipes and wire subways.

The four-track level system accomplishes the purpose without going so deep as the double-deck system, and without disturbing the present pipe systems; leaves the space above free for constructing permanent pipe galleries later, leaves the water mains undisturbed, and leaves freer opportunity for connections between pipes and houses.

Ten feet clear height is sufficient for the tunnel, and cars 8 ft. 6 in. high will pass through this 10-ft. tunnel and will meet all requirements. Ventilation by monitor roofs is not essential. Mr. Worthen's plan of taking in air at the front of the train while in motion can by proper control be carried out. The cars should be used with fixed windows.

Refuge niches, 2 to 2½ ft. wide, high enough for a man to stand, with a hand-rail to hold by, should be provided every 10 or 12 ft. The 2-ft. walk suggested by Mr. Parsons is not sufficient.

In fixing an assumed load as a basis for calculation, account has properly been taken of the risk from falling walls. The mass of earth above the tunnel in the four-track level system will modify the effect of the impact from live loads, but the dead load is so great that the assumed total load should be about the same in either case. For the 2,000 lbs. per sq. ft. assumed by Mr Worthen, 15-in. roof beams are not heavy enough for 22-ft. spans; they should be 20 in., or have intermediate columns, the latter being preferable as better distributing the load on the foundations.

The station platforms for the four track level road are near enough to the surface to be reached by stairs, but with the double-deck system elevators must be provided at the express stations. In this system the local traffic is favored at the expense of the express. Stairways in stations should be made broad and easy, with risers not over 6 in. and treads from 12 to 14 in. In this respect Mr. Parsons' plans are the better.

In the four-track level system it would be best to deflect the local track at all stations, whether local or express, and use island platforms. This will permit easy change from local to express stations. The divergence of the tracks is not a matter of importance.

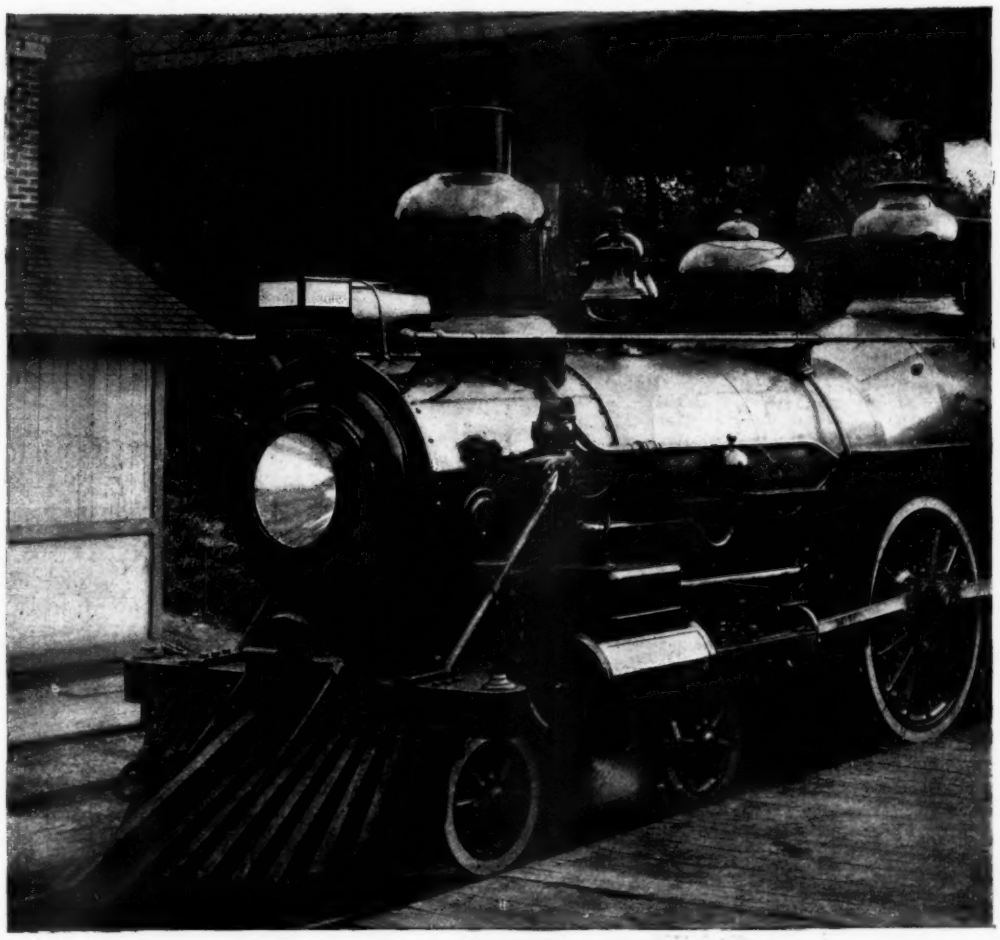
But little artificial aid will be required to render ventilation satisfactory. The whole tunnel should be left open, the cars ventilated by a regulated admission of air at the front ends, and the use of exhaust fans midway between stations.

The construction will be a difficult operation by any method, and will require great care and foresight, with skill and ability to meet exigencies which it is impossible to anticipate. But the injury to business interests from interference with the use of the streets by open construction is enormous, and cannot be estimated. In this respect Mr. Worthen's plan is far better. Moreover, any system of open construction is liable to serious interruption and damage from surface water in times of storm. In underground work this difficulty would not occur, and so long as the grade is kept above tide the tunnel would be free from water. In the open construction the care of gas and water pipes and their re arrangement in the gallery is a more serious matter than might at first be supposed. The pipes will be met at unexpected places, often interfering with the proper places for beams or columns. Their temporary supports may be washed out or set le, causing breakage, leakage and untold damage. In Mr. Worthen's system these risks are reduced to a minimum. But his proposed method of excavating transversely from the curb line will require more study and elaboration before it can be practically applied. More timbering and temporary shoring will be needed than he appears to contemplate.

In conclusion I give my opinion in favor of the four-track system, essentially as submitted by Mr. Worthen, with such modifications in detail as I have suggested, for the following reasons: Better facilities for connections with branches, less interference with adjacent foundations, no disturbance of pipes and wire subways or other connections, better facilities at stations for the transfer of passengers, better capable of being ventilated, better facilities for construction with less obstruction to street travel.

Cavner's Device for Pre-heating Air for Locomotives.

A device recently tried on engine No. 34 of the Chicago & Alton has attracted some attention on account of the principle by which it was designed to economize fuel. Instead of *drawing* the gases through the flues by the use of the exhaust with short, sharp drafts, the air was *forced* through at a steady and comparatively low pressure, producing an even lift on the fire. In theory the working of such an apparatus is correct, and with a proper proportioning and placing of the various part of the design, the saving should be marked.



Cavner's Device for Improving Locomotive Draft and Combustion.

What were claimed by the inventor, A. R. Cavner, as the prime objects to be secured by this device were: First, greater economy in the consumption of fuel; second, the entire abolition of the smoke nuisance; third, reducing the back pressure on pistons to the lowest possible minimum; fourth, reducing the vibration on flues; fifth, making the locomotive available for an incandescent electric lighting system at a small expense and without material change in construction or appearance of the engine.

The saving of fuel and the abatement of the smoke nuisance to be accomplished in the following manner:

The extension front extending from the flue sheet to the cast iron door to be divided into two compartments by a light cast vertical partition extending entirely across the front just forward of the exhaust pipe, thus confining all the heated gas, exhaust steam, etc., in the compartment next to the flue sheet, and having direct communication with the fire-box. No change is made in this compartment except that the tips on the nozzles are taken off from the exhaust pipe. The exhaust opening is left fully open. The stack and saddle are taken off and the stack opening increased to 20 in. in diameter. There is placed over the exhaust a lifting pipe 12 in. at the bottom, tapering to 15 in. at the top and 40 in. long. A sheet iron pipe, 20 in. in diameter, sits over this and rests on top of the extension front, terminating at the top with a 16-in. stack. Over this is the ordinary dome casing. This casing is perforated with 2,000 $\frac{7}{16}$-in. holes, extending half around on the front side of the casing, as shown in the accompanying cut. On the inside of this 20-in. pipe there is coiled 52 ft. of 2-in. brass pipe. The pump, or injector, forces the water through this coil of pipe from the top down through the centre and out the side of the extension front through the check into the boiler, as shown in cut. This water passes from the injector to the boiler through brass pipes surrounded with the exhaust steam and hot gases. It takes up the units of heat that would be otherwise wasted, and goes into the boiler at a temperature above boiling point, or about 220 degrees.

The forward compartment of the extension front is used as a receptacle for the mechanism by which the draft is secured and power to run the dynamo. In this compartment these is located a No. 5 pressure blower also a small 16 H. P. rotary engine. This pressure blower is connected by direct friction to the small engine, and is also connected direct by an air pipe extending from the front end of the engine down and back under the trucks to the ash pan. The ash pan and dampers, having asbestos joints and shutting firmly, make them air tight. This fan, running at 2,400 revolutions per minute, creates a 7-oz. air pressure over the entire grate surface.

The air by which the fire is forced is drawn down through the 2,000 $\frac{7}{16}$-in. perforations in the dome casing. This air comes in contact with and circulates through these pipes, and is heated to a high temperature by the exhaust steam and heated gases. The result is that by this method the fire is supplied with a constant blast of hot oxygen at 7 oz. pressure, this air being heated by otherwise waste heat. A portion of this hot air is conducted in pipes branching from the main pipe through the ash pan up through the fuel and is forced into the flame from the back of the firebox toward the flue sheet and encircling the firebox door in a number of small holes. This hot oxygen uniting with the carbon burns as a gas, completing the combustion and preventing all smoke, whether the engine is working or shut off, or whether there is a light or a heavy fire. This branch air pipe extends forward of the air regulation valve in the main air pipe so that when the draft is shut off from the fire there is still a constant pressure of air through the small pipe and blown in jets into the flame above the fuel, thus making of the firebox a gas retort consuming the carbonic oxide gas, which would otherwise pass off in smoke. As the only service required of the exhaust is to secure sufficient draft to draw the heated gases from the firebox through the flues and expel them into the atmosphere, a wide open exhaust may be used. For instance, engine No. 34 formerly ran with a 3⅜ single exhaust, whereas with this device a 5½-in. single exhaust is used. This relieves the back pressure very materially and prevents the constant vibration of the flues caused by forced exhaust; hence, materially lengthening the life of the flues.

The steam that drives the little rotary engine is taken from a ¾ valve in the cab, and is conducted through the hollow hand railing on the left hand side of the engine. This is covered with asbestos to prevent radiation. This places the little engine in full control of either the engineer or fireman directly from the cab, and is self maintained; *i. e.*, lubricated, speed regulated, started and stopped from the cab without attention from the front end.

This little rotary engine also runs the dynamo; the blower and dynamo being so adjusted that either one can be thrown on or off from the cab at will. The dynamo, a Bain 320-candle power, is placed on top of the extension front where the headlight formerly stood. The dynamo is covered with a metallic housing. In this housing is a 16-candle power light. This housing also answers as an electric engine and train number indicator. The head light is supplied with a 75-candle power incandescent light. The red signal lights at side of front end are each supplied with a 16-candle power light. When these signal lights are thrown on from the cab they are automatically locked. This absolutely prevents the lights being changed or extinguished by anyone except the engineer. Should these signal lights go out they are so connected up that the entire engine is thrown into darkness instantly.

There is also a 16-candle power light in the front end of the extension front which lights up the interior. A glass is placed on the side of the extension front in the hand pole plate, giving a full view of the interior. The wires conducting the electrical current from the front end to the cab pass through the right hand railing. In in the cab there are two 10-candle power lights—one for the steam gauge and one for the water glass. There is also at the back of the cab a 50-candle power light, with a 12 in. reflector, throwing a brilliant light over the entire tank and water hole. This also serves as a rear head light while backing the engine through yards.

All these lights are so adjusted that any one or all of them may be turned on or extinguished from the cab at will except the signal lights as above explained. The head light signals and cab lights are well equipped with their ordinary oil burners, so that in the event of any accident to the dynamo the engineer may quickly light up in the old manner. This feature also holds with the exhaust draft. An opening is made in the partition in the front end opposite the exhaust pipe so that should occasion require this may be opened and the tip screwed on for a forced exhaust.

This device can be placed on any locomotive in from three to five days.

When it becomes necessary to clean the ash pan of clinkers, etc., the valve in the main air pipe is closed, the back damper opened, the blower started and valve opened, and all ashes will be blown out instantly. On account of liability of fire this should only be done at terminals or watering stations. By the use of this hot air blast the draft on the fire may be exactly regulated to suit the condition of the fire or quality of coal.

This device has, we understand, owing to the inability to keep up steam, been taken off this engine.

Eight-Spindle, Vertical Gang Borer.

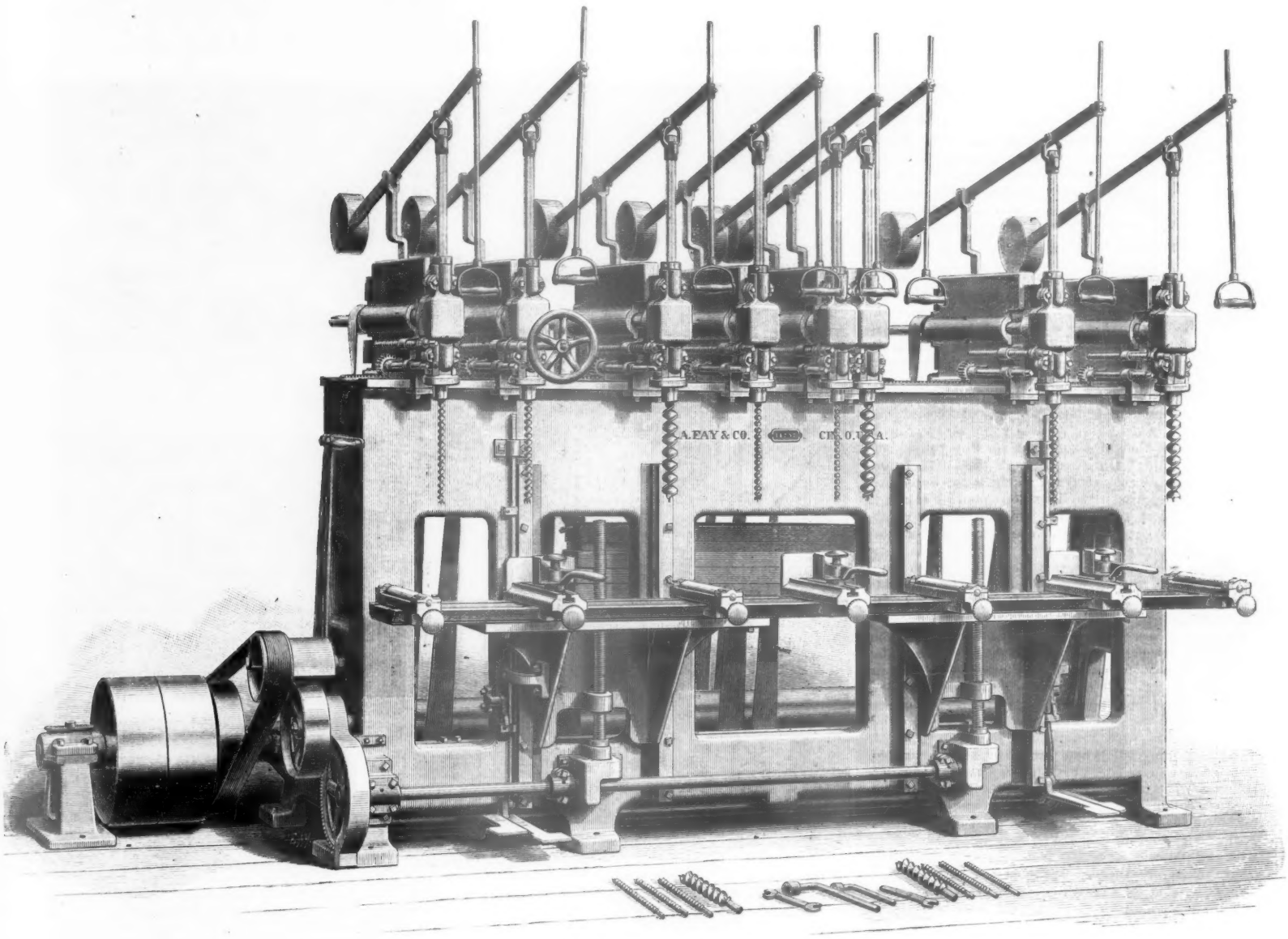
We show herewith a large boring machine for use in the manufacture of railroad cars and for similar purposes. The machine is extra large, has eight boring spindles, each adjustable in vertical and lateral directions. The machine is massive and of extra strength to provide for the handling of the largest timbers. It is provided with a strong and heavy table adapted to be raised by power by mears of a pair of large, square-thread screws, operated by an improved friction device. The table-elevating mechanism is controlled by compound treadles, a pair of which is located at each end of the table support. Stops are provided for regulating the depth of hole boring, one of which acts to automatically stop the table movement. The machine will handle timber 14 in. square, friction rollers and eccentric clamps being used for handling, moving and gripping the timber.

The boring spindles, eight in number, are made of steel and are independently adjustable up or down or across the machine. A screw and hand-wheel effect the transverse adjustment; and a counterbalance lever with attached handle effects the up and down movement. The movement either way is 14 in. to suit the largest timber taken by the machine. Each spindle is provided with a stop collar for gauging the depth of bore, and for holding them securely in position, while the material being bored is raised to the bits. Additional boring spindles may be added as desired.

For longitudinal adjustment the spindle carriages as a whole are moved by means of a rack and pinion, the rack extending the whole length of the machine, and the carriages moving on slides are provided with clamps to hold them firm in any desired position. With the outer boring spindles at their extreme end-reach, two holes may be bored 10 ft. between centres, and 8 holes may be bored from 4½ to 17 in. between centres. Any two of the spindles may be brought to a distance of 4½ in. between centres, and each spindle is revolved by a separate belt, taking motion from a drum extending the whole length of the machine.

The machine as a whole is very massive, has a heavy frame, with every joint accurately planed and fitted, the metal being carefuly distributed where stiffness and rigidity are required.

The machine is manufactured by Messrs. J. A. Fay & Co., of Cincinnati, O., and they claim its superiority over all other machines of the kind, "in the wide range of work and perfect adaptability to requirements," also "through the automatic and simultaneous action of the augers the capacity of the machine is increased to about three times the usual speed of production," likewise that "the boring of the augers is sufficiently accurate to dispense with reversing, when the holes are to correspond on both sides."



NEW EIGHT-SPINDLE VERTICAL GANG BORER.

Made by Messrs. J. A. Fay & Co., Cincinnati, O.

A Machine for Rolling Car Wheels.

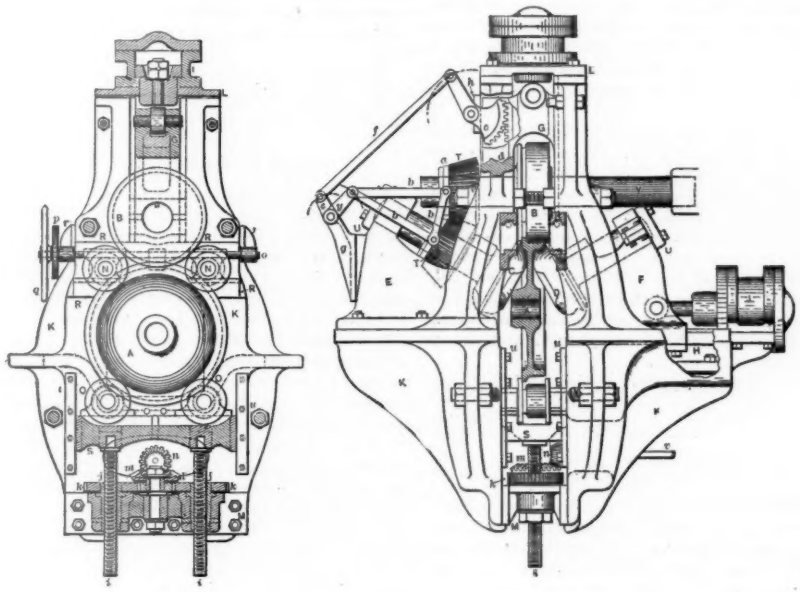
The machine which is illustrated was designed by Mr. John R. Jones, of the Pencoyd Iron Works, Philadelphia. For the illustrations and the following description we are indebted to the *Iron Age*.

A cast steel car wheel, blank or bloom, having the hub near the desired proportions, and the web and rim thicker than is desired in the finished wheel, is placed between three rolls—a movable driven tread roll and two side rolls—one of which operates in sliding bearings but is not driven, the other is driven rotating in fixed bearings The movable tread roll in its sliding bearings is made to approach the side rolls during the continuance of the operation. The tread roll is designed to give shape to the tread and flange of the wheel, and is movable by means of hydraulic pressure to compress, harden and extend the wheel to any desired diameter while being supported and revolved by the side rolls. The side rolls operate on, compress and harden the web of the wheel, assist in revolving the bloom, holding it in position to be acted upon by the tread roll. One of these side rolls runs in fixed bearings, the other, which is sliding on bearings, moved by means of hydraulic pressure, rolls the web of the wheel, elongates it, hardens and compresses the metal, moving inward toward the fixed side roll. These side rolls are of greater diameter than one-half the diameter of the wheel.

During the operation the metal flows outward from the center toward the rim; at the same time the tread of the wheel is elongated and increased in diameter by pressure being given to the tread roll. The metal of the hub is rolled and hardened by means of the co-operation of the side roll with the

steadying rolls. This is done by holding the side rolls on fixed bearings while rotating them, and bringing pressure to bear upon them through the bloom from the steadying rolls *O O*. This pressure can be secured from the main shaft *V* through the pulleys on the shaft *v* and its pinions and sliding cross heads to the rolls *O O*.

The front view of the entire machine shows the finished wheel in position between the rolls at the completion of operations; the roll *C* being withdrawn to show it in full lines, its normal position, however, being against the lower edge of the wheel. The side view of the machine at half section shows the wheel *A* in full. *A* is a finished wheel in position between the rolls. The tread roll *B* is coupled to the main shaft *V*. The coupling is so constructed as to permit the roll *B* to



Front View. Side View.

THE JONES CAR WHEEL ROLLING MILL.

move up and down on its slides in the housings *G*. A movable housing, or yoke, carries the tread roll *B* in its boxes. *I* is a hydraulic cylinder which presses the tread roll *B* against the tread of the ingot *A*. *C* and *D* are side rolls, so designed that as the wheel nears its required size the rolls *B*, *C* and *D* nearly develop the metal of the tread. *C* is a driven roll revolving on fixed bearings, and *D* is a friction roll rotating on sliding bearings, movable under pressure.

The housing *E* which supports the roll *C* is fixed and is bolted to the main housing *K*. The housing *F* which supports the roll *D* is worked inward and outward upon the slide *H*; by the pressure of the cylinder *J* it can be made to advance or can be held in any position while the wheel is being finished, or can be made to recede to allow the wheel to be removed. The side roll *D* has no positive motion. The only motion it receives is that which comes through the ingot from pressure against the side roll *C*. The side roll *C* has a positive motion through the bevel gear wheels *T* and *T* from the main shaft. These beveled gear wheels are kept in gear and at the same pitch line by means of the bell crank with its levers and the links controlled and operated by the rack *d*, which is bolted on the sliding yoke *G*. The bevel gear wheels *T T* slide on the shafts of the rolls *B* and *C* over a key fastened to the shafts. The sliding motion is secured through the bell crank *c*, its links and levers by the movement of the rack *d* on yoke *G*. The bell crank *c* is supported by the housing *K*, and is connected with the rack *d* by means of cog gearing, and any motion of the rack is communicated through the link *f* to the levers *e* and *g*, which are supported in barings on the housing *E*, and from them through the links *b b* to the wheels *T T*; either pushing them forward on their shafts, or withdrawing them, thus keeping them in gear, and on the same pitch line.

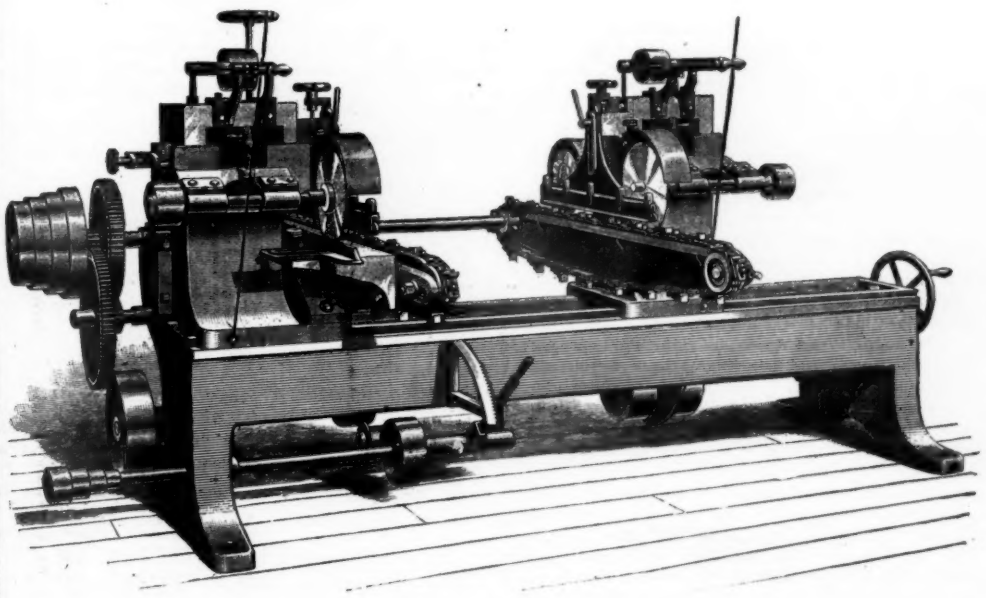
The top rolls *N N* always bear on the wheel to stop its lateral motion, and toprevent the formation of fins while the wheel is being rolled. As the wheel increases in diameter, the rolls are moved slightly apart to suit, by means of the screws *o o*, Fig. 1, which are turned by the hand wheel *q*, and gearing to each other with wheels *p p*, one only being shown in the drawings. The screws *o o* are each cut with a right and left-hand thread, and are held in position by the bearings *r r*. The boxes which bear the steadying roll *N N* are threaded to suit the screws *o o*, and move along the slides *R R*. As the wheel nears completion the lower steadying rolls *O O* are brought into play. They, in their bearings, *Q*, fig. 1, are fastened to the cross-head slide *S*, which moves up and down on the inside of the main housing, and are held in position by the bolted shoes *u u*. As these rolls *N N O O*, which are grooved and shapedto inclose the tread and flange of the wheel, are brought against, it the pressure of the side rolls is continued, while the tread roll *B*, pressing slightly on the ingot, rolls it around on the steadying rolls *O O*, finishing off and rounding up the wheel to its proper size. If, from any cause, the wheel has been rolled slightly above size, pressure on both the tread roll and the steadying rolls *O O* would reduce it to some extent. The movement of the lower cross-head *S* is controlled by the operator through the main shaft *v*, which is belted by means of an open and cross belt to the pulleys on the shaft *v* to give reverse motion. A friction pully, or in fact any means, can be employed to give forward and reverse motion to the shaft *v*. This shaft *v* is set in the machine pit, supported by bearings, and has on its end the bevel gear wheel *n*, which gears to the idle set *m* and *l*, rotating on a stud fastened to the girt *m*, the pinion *l* on the set transmitting the power and motion to the open gears *k k*, which are keyed to the bronze nuts *j j*. The revolving nuts *j j* raise and lower the screws *i i*, keyed and pinned to the hubs of the cross-head *S*. This moves the cross-head *S* and lowers the steadying rolls *O O* to the desired position. When the wheel is rolled to the proper size and the metal is set enough so that it can be handled, the cylinders *I* and *J* are reversed, the yoke *G* and roll *B* are raised from the tread, the housing and roll *D* are moved back, the cross head *S* and rolls *O O* are lowered, and the wheel *a* can be removed. The whole operation requires about three minutes.

Improved Double Tenoning Machine.

The accompanying illustration gives a good idea of a new double tenoning machine manufactured by the Egan Company, of Cincinnati, Ohio. It has a new automatic feed and double cut off attachment. Simplicity, ease and economy of operation, durability, strength and compactness are the special features claimed by its manufacturers.

The frame or bed is a single casting, heavily ribbed and braced, with ample spread to its supports. The end operating housing is fixed, and the moving housing is adjustable to suit length of stock to be operated upon. The mandrels are of cast steel and revolve in self-oiling babbitted boxes. All mandrels and slides have separate adjustment up and down in the housings and the upper mandrels have side adjustment as well, for varying thicknesses and length of tenon. The saw mandrels are somewhat in advance of the cutter heads and are adjustable, independent of each other.

There are four changes of feed provided for in the machine and it is made suitable to all kinds of work necessary for car construction and fitting.



Improved Double Tenoning Machine.

Emery Wheels.

What follows is a report by Coleman Sellers, J. E. Denton and Alfred R. Wolff, on "The Comparative Value of Fifteen Varieties of Solid Emery Wheels":

At the suggestion of the Tanite Co. we associated ourselves in an inquiry as to the comparative value of the solid emery wheels. Our first object was to settle the question as to what constitutes a good solid emery wheel; second was to establish test conditions of such scientific accuracy as to prevent any doubt of the results; third, to give thorough trial, under uniform test conditions, to the various wheels, and to secure a mass of exact data.

Having determined on the qualities which constitute a good solid emery wheel, we established our own conditions of test, and submitted to such conditions wheels of our own selection. The wheels of fifteen different manufacturers were selected. These were: Celluloid, Crystal, Detroit, Grant, Hampden, Lehigh, Norton, Northampton, Norwich, Sterling, Tanite, Union Stone, Vitrified, Vulcanite, Waltham. Among these fifteen varieties only one compared favorably with the Tanite Wheel, the latter having easily beaten all competitors save one. The comparative values of the Tanite and its one rival will have to be ascertained by further trials.

It was unanimously agreed that hand testing must be done away with and the personal factor eliminated, in order that the results might be unimpeachable. The defect of existing test machines was speedily recognized, and it became necessary to invent a new testing machine. After much study and many trials your Board, with the valuable assistance of Professor Webb, of Stevens Institute of Technology, at Hoboken, constructed a machine which met the approval of all concerned. This machine was so constructed that the wheel and work were brought in contact by definite and measurable pressure without any obstacle being interposed to the free wear of either metal or wheel. The results approximated closely to those obtained by hand pressure, and yet were independent of all influence from the operators of the machine. The power consumed was measured by a dynamometer attached to the driving shaft, and the speed recorded by a tachometer. The resistance between wheel and metal was indicated continually by a standard scale.

To constitute a good solid emery wheel the following qualities should be combined: Safety under the widest conditions of use and misuse; rapidity of cut; freedom of cut at moderate pressure; reasonable amounts of wheel loss and power consumption: evenness of wear; general staying quality, and reliability under the widest range of circumstances. Our board had the test machine erected in the machine shop of the Stevens Institute of Technology at Hoboken—and had the various wheels (bought directly by themselves) delivered at Stevens Institute. The grinding was done on cast iron bars supplied directly to us by one founder, special care being taken as to quality of metal and size of bar. The trials reported on were made at the Stevens Institute during 1889 and 1890, the tabulations being too voluminous to admit of detail here. During the latter part of this investigation the assistance of Prof. Jacobus (assistant professor of experimental mechanics at Stevens Institute) was secured.

Our report is based on along series of trials at three different pressures—42 lbs., 60 lbs. and 100 lbs. These separate trials numbered several thousand, during each of which exact data were recorded as to speed, power, resistance between wheel and metal, amount of metal ground off, amount of wheel material consumed, and observations made us to the cleanness of cut, amount of heat generated, amount of glazing or clogging up of wheel with metal, and as to cracks, breaks and defects of wheels.

Of the fifteen varieties six were found too unsafe to warrant their general use, 57 per cent. of the wheels bursting under the same conditions which other wheels passed through uninjured. Eleven varieties (among which are included the six unsafe varieties) were found to be such slow cutters that the average metal removal of ten of them was less than the general average of all the wheels. Of the fifteen varieties only four were found to be rapid cutters. Of these one wore so rapidly that the cost of its rapid cut was unreasonable. This left three, safe, effective and satisfactory wheels, one of which, however, was demonstrated to work at a greater cost than the tanite. The rivalry was thus narrowed to two wheels, and, in the judgment of our board, further trials are necessary before the relative value of these two can be determined.

One striking feature characterized these two. That is, that in every series of trials these wheels increased in productive capacity, the average of the last cuts of all the series being greater than the average of all the first cuts. The 13 other varieties all decreased in productive capacity, the average of the last cuts being less than the average of the first. Some of these which made a brilliant show at the start cut scarcely anything at the close.

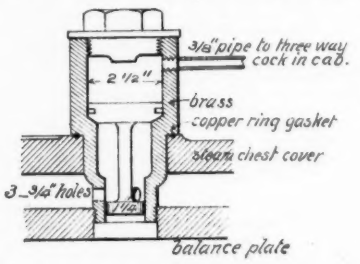
As nearly all the preliminary and collateral trials were made with tanite wheels more than three times as many of these were used as of any other make. In all this use, under every degree of measured automatic pressure and under the heavy pressure of long bars used by hand (a test applied to no other wheel), and also at a

speed nearly double that of any other wheel save one, *not a single wheel burst.*

As evidence of these facts, thus summarized and stated in a general manner, we possess an overwhelming mass of exact data in the form of numerical tabulations. These details are reserved for future publication, and we content ourselves now with this brief report, and with a still briefer abstract for the use of hasty readers.

Johnstone's Starting Valve for Compound Locomotive.

The starting valve shown with this is the one that is used on the Johnstone compound locomotive recently built at the Rhode Island Locomotive Works. When running "compound" this valve is held down in the position, as shown, by the steam through a ⅜-in. pipe. When it is desirable to obtain extra power at starting, a small three-way cock, fastened to the boiler just in front of the engineer, allows steam to escape from this pipe so that the piston valve rises because of the excess of pressure on the lower side of the upper piston. This is sufficient to allow live steam at boiler pressure to rush in through the three ¾-in holes in the valve casing and down



through a 1¼-in. hole, into the space surrounding the low pressure valve, whence it enters the low pressure cylinder. When the engine is standing still and the low pressure ports are open, the live steam will thus continue to enter the cylinder until the pressure behind this large piston is sufficient to start the train or slip the drivers. As soon as the drivers revolve with much velocity the amount of steam entering through the 1¼-in hole is small, so that the effectiveness of this piston valve is only at slow speeds. The ⅜-in. pipe from the cab is carried under the jacket to the front end thence down the centre of the steam chest cover.

Recent Illinois Central Fruit Cars.

The necessity on the Illinois Central railroad for a good fruit car is more apparent each year, as that road is shipping increasing quantities of perishable goods between the south and the north and northwest, which are transferred to it at the Gulf ports, and where insufficient or improper ventilation would frequently mean serious loss. With a continuous run of 1,000 to 1,500 miles the problem requires careful attention to details and arrangements, and much has been done in this direction by the mechanical department of the road.

There have been at various times different designs for fruit line cars of more or less efficiency for this class of service, and the experience of the Illinois Central has been wide and varied. A lot of 25-ton cars is now being built for the company at Pullman. These are 35 ft. long over end sills, the posts and struts are set without cast pockets, and the regular circular roof, standard on this line, with the projecting running boards is used; the whole being painted white with a very neat system of black lettering.

The chief feature in a car of this character is, of course, the mode of ventilation adopted. In this instance the roof ventilators are of the usual form of iron funnels, two in number, placed diagonally opposite. The grating ventilators just under the roof on the sides are twelve in number, four 22½ in. × 28 in., and eight 14¼ in. × 28 in., provided with inside sliding doors run on overhead trolleys, and held in by 1¼ in. × ⅛ in. iron strips. Below these are four springs on each side 18½ in. square with ½-in. round iron slats and having swinging doors on the outside and flush slides on the inside. The side and end main doors are double in each case, one slat and one solid, moving on the same runners, they being made one half again as long as customary and extending equal distances each side of the door opening. On either side of the regular end doors are 8-in. slat openings having inside covers, and below are three double slat openings with inside flush covers and outside slides. Under the floor the spaces between the side and intermediate sills are formed into boxes by means of $\frac{13}{16}$-in. sheathing fastened on strips 5½ in. below the main floor. These extend to within about 18 in. of either end where they are provided with swinging doors hung from the top, so that in whichever direction the car is running, one of these flaps swings open while the other is kept closed. The main floor has four 12-in. × 20-in. slat openings with hinged covers of sheet iron which when closed down are flush with the planking. Thus making in all about 170 sq. ft. of slat surface for ventilation, any or all of which may be closed at will, and so arranged that where not used for fruit the car may have the inside slides shut and be put into regular grain or other service, the end doors enabling their use as lumber line cars. This facility for changing from one service to another and for also ventilating from the outside make this design of particular merit.

Test of the Shortt Duplex Automatic Brake.

The first public exhibition and test of the Shortt duplex automatic brake was made on Wednesday, Oct. 7, on the Carthage & Adirondack Railroad, near Carthage, N. Y., under the direction of Mr. G. F. Higgins, Superintendent of the railroad in question.

The brake is operated by compressed air, and acts automatically like the Westinghouse, Boyden or New York, and may be operated in connection with them. The operation depends upon the variation of the pressure on the two sides of the working piston—in fact, one side of the piston, when it is in normal position, is the car reservoir, and the other the brake cylinder. The latter is connected with the train pipe through what corresponds to the triple valve. When the pressure is relieved in the train pipe, the compressed air in the reservoir expands against the piston and applies the brake.

The valve is simple and compact, readily accessible and probably not liable to stick or get out of order, and is attached to the back head of the cylinder.

The air pump is on the duplex principle and compresses at each stroke. Thus, if pump or piston is at the upper end of the stroke, on its downward stroke it allows all the air below it to pass through a check valve into the upper portion of the cylinder, which has one-half the capacity of the lower end when the piston is at the top, thus partially compressing the air. On the upward stroke the air is further compressed and driven into the reservoir.

The tests of Wednesday were made on a train made up as follows:

		Pounds.
Locomotive weighing		66,980
Tender	"	30,980
10 flat cars,	" 23,000 lbs. each	230,000
Caboose	"	26,710
Total weight of train		354,670

The engine was of the eight-wheeled American type and equipped with a Boyden air pump; the tender had the Westinghouse automatic air brake, piped with ¾-in. pipe; the remainder of the train, including caboose, had the Shortt duplex automatic brake. There was no brake on the engine. The engine cylinders were of 17 in. diameter and 24 in. stroke. The brake pressure was about 80 per cent. of the weight of the cars.

The stretch of track upon which the experiments were made was about 20 miles from Carthage and was straight and level, approached by a slight ascending grade. Stakes were driven beside the track 100 ft. apart, over a stretch of 1,100 ft. There was an additional stake one-quarter of a mile from the zero station on the approaching side of the course.

At each test a torpedo was placed upon the track at the quarter mile post and at the zero station. The work was done and the time taken at the explosion of these, while measurements were taken from the centre of the forward truck wheel. A timekeeper stood midway between the torpedoes and a second was on the engine. These men took the time of running the quarter mile, and thus secured the rate of speed at the time of application of the brake. A third timekeeper was on the engine who took the time from the application of the brakes to the stop. On the seventh test, however, this last timekeeper was at the forward end of the front car.

The train was backed down a mile or so from the quarter mile stake, and acquired speed before reaching that point, the engineer being instructed to maintain as even a speed as possible from the quarter stake to zero station.

The track was smooth and well ballasted, but the drizzling rain of the morning, which settled into the steady downpour of the afternoon, put the rails in about as bad condition for quick stops as they could well be, unless a little sleet had been added.

The following is a schedule of the stops:

Stop.	Speed in miles per hour.	Time from application of brakes to stop	Distance run after application of brakes.	Pressure in train pipe at time of application of brakes.	Remarks.
		Secs.	Ft. in.	Lbs.	
1.....	23.75	57	1,237 7	62½	Service stop.
2.....	21.75	13	288	64	Emergency stop.
3.....	33	18¼	607 3	62½	" "
4.....	42.5	27½	1,117	62½	Stopped by opening conductor's valve, engineer's valve remaining in running position, throttle closed.
5.....	43	23½	674 9	64	Conductor's valve opened, and 7 seconds later engineer's valve moved to emergency position and throttle closed.
6.....	46	19	790	64	Emergency stop, conductor's valve also opened as soon as brakes were applied.
7.....	43	14	493	64	Breakaway between tender and front car.

As an evidence of the confidence which the promoters have in this new device, the engineer's valve, which is of a novel design, was never used until Tuesday, the day before the trials, and after all of the invitations had been sent out.

In comparing this test with others that have preceded it three things should be borne in mind; the bad condition of the rails, the fact that the engine had no brakes, that its weight constituted 18.88 per cent. of the total weight of the train; and finally that the tender was piped with ¾ in. pipe whereas the train was equipped with 1 in. pipe, so that the reduction of pressure in the train pipe was somewhat delayed.

All of the stops were made smoothly and without any perceptible shock either upon the engine or in the caboose; the release seemed to be prompt and reliable, though the train was not equipped in such a way as to render it possible to determine the lapse of time between the movement of the engineer's valve and the release of the brakes upon the last car. It is probable that in the near future another series of public tests will be made on a train more thoroughly equipped for closely accurate work.

In a coming issue we shall publish a complete set of details, showing the construction of the brake and its attachments in all of its parts.

A New Safety Device for Elevators.

A set of the safety devices for use in connection with the three large passenger elevators being constructed for the North Hudson County Railway Co. at Weehawken, by Otis Brothers & Co., was subjected to a preliminary test in the presence of several officers of the railroad company at the elevator works at Yonkers last Tuesday. The three elevators are located on the New Jersey side of the Forty-second Street Ferry, and are intended to carry passengers between the ferry and the railroad above, and are placed side by side in the first of a series of towers supporting the railroad viaduct. Each elevator has a lifting capacity of 23,000 lbs., equivalent to about 135 persons, at a speed of 200 feet per minute, and will therefore make the ascent of about 150 feet in 45 seconds. The power is hydraulic; water being stored in compression tanks under a pressure of 190 lbs. per square inch by means of two compound condensing Worthington pumps of about 85 H. P. each, taking steam from three internal furnace return tube boilers of about 100 H. P. each. Two boilers only are intended for use at one time, the third being held in reserve. These elevators are the largest yet constructed for passenger service.

The apparatus for testing consisted of a heavy timber trestle supporting the guide strips, between which a temporary cage loaded with 34,000 lbs of cast iron, equivalent to the weight of the cars and their load of people, was suspended on a trip lever, the support of which could be disengaged by pulling on a light line. The safety grips, which were the actual ones to be used on the permanent elevators, were placed under the cage, one on each side in their proper position with relation to the guide strips. From each safety grip a light line representing the governor ropes to be used on the elevators was carried to and attached to the crosshead of the timber trestle.

At the signal the lanyard was pulled and the cage with its load released. It dropped freely about 2 in. when the safeties engaged with the guide strips and after a further slide of 1¼ in. came to rest without shock. The guide strips are of yellow pine 6 in. × 8 in., built up in three pieces of about 2⅜ in. × 6 in., strongly spiked together, and are secured to the latticed channel iron posts of the elevator tower by ¾-in. bolts spaced about 14-in. centres; the heads of these bolts are countersunk in the faces of the guide strips so as to leave a smooth guiding surface. The safety grips consist of forgings with a rectangular notch surrounding the guide strip, the edges of the notch being bevelled to form cutting edges. Below the main forging is bolted a plate with a similar notch, but having toothed edges, the whole swinging on a centre so placed that when the safety is in normal position the toothed and chisel edges are well clear of the guide strips, but when swung outward they engage and cut into the guide strip on its face and two sides.

After the above test, a second test was made, with a load of 36,000 lbs., and under this load the fall was substantially the same as in the first test. A section of the guide strip was sent to the office of the North Hudson County Ry. Co. and the corresponding section of the other guide strip is preserved in the office of Otis Brothers & Co.

When a test was made of the elevators erected by the Otis Company in the Eiffel tower, in the first test the elevator, which with its load weighed 32,000 lbs., fell 12 ft. before the car was stopped, and the directors of the exhibition, French engineers and spectators were exceedingly gratified at the result. The second elevator in the Eiffel tower was afterward tested, after readjustment of the safeties, and when the rope was cut fell but 8 in. This was a disappointment to the spectators, one celebrated engineer remarking, "Is that all?"

There were present at the Otis Elevator Works on Tuesday Mr. F. J. Mallory and Mr. Hilrich Bonn, directors, Mr. DeBevoise, superintendent, and Mr. E. A. Trapp, engineer of the North Hudson County Ry. Co., who expressed themselves as greatly pleased with the result of the tests. The works of the Otis Elevator Co., at Yonkers, are well worth a visit. Their hydraulic, steam and electric elevators have established for themselves a reputation throughout the world.

The elevators and safeties were designed by Mr. Thos. E. Brown, Jr., Consulting Engineer for Otis Brothers & Co., under specifications prepared by Mr. Ed. A. Trapp, Engineer for the North Hudson County Ry. Co.

Experiments Upon the Velocity of Steam.*

A series of observations upon the peculiar shapes assumed by a jet of steam upon issuing from orifices of different forms led the writer to the supposition that a discharging nozzle could be so proportioned as to give the maximum efficiency of expansion under given conditions, and numerous experiments were therefore made to determine the internal pressure and velocity of the steam at different sections of tubes of various shapes. The results obtained at 30, 60, 90, and 120 lbs. initial gauge pressure are shown by diagrams and tables accompanying the paper, and indicate very interesting results, while the characteristics of some of the tubes are quite marked. As might be expected, a cylindrical nozzle is shown to be the least efficient, and the terminal velocity of the steam in this tube is found to be the same as at the initial section of the tubes with divergent taper. In the latter style of tube the steam has more opportunity for expansion, and the terminal velocity approaches more closely the theoretical value.

A peculiar circumstance is noted in the text and made very apparent by the diagrams—viz., that in a well proportioned nozzle or thin diaphragm the actual velocity of discharge at the minimum section is very nearly constant for all the pressure of steam used in the tests, and for any other section of the tube the same condition obtains as long as the expansion is continued. This qualification seems to be neccessary, as several instances are given where the expansion within the nozzle falls far below the atmospheric pressure and subsequent contraction causes a loss of velocity.

This fact of constant velocity of discharge under certain conditions is commented upon at some length and shown to give good ground for the use of Napier's formula for discharge of weight of steam, with the suggestion that the use of the initial density of the steam instead of the absolute pressure might give even more accurate results.

Air Brakes in Freight Service.

At the last meeting of the Western Railway Club Sept. 15, Mr. G. W. Rhodes presented a paper, which is abstracted below, on "Air Brake Practice:"

At the recent annual convention of the Master Car Builders' Association held at Cape May, a very thorough and carefully prepared report on the subject of "Air Brake Standards, and Inspection and Care of Air Brakes on Freight Cars," was submitted by Messrs. J. S. Lentz, Lehigh Valley R. R., Wm. Turreff, New York, Lake Erie & Western, and N. W. Sample, Denver & Rio Grande. The feature of the report which we, as railroad men, should be most interested in, is the code of rules which it was proposed by the committee should be indorsed by the Association, and issued in a form suitable for general distribution among railroad employés concerned in any way with the operation or maintenance of the air brake apparatus. This report which you are doubtless all familiar with, as it has been distributed in pamphlet form to each member of the association, has been laid over for revision and presentation at the next annual convention.

What we shall have to say will be mostly a repetition of what has already been said at the Cape May convention. It is hoped, however, that as at our monthly club meetings there need be no rush to dispose of topics, a more interesting and instructive discussion will be had here than took place at the annual convention.

The rules are prefaced by some general instructions offered as suggestions to general managers and other officials on whom the responsibility of issuing the books would fall. In the second paragraph under the above caption, on page 1, we find the following:

Every employé, whose duties are connected in any way with the operation of the air brake, will be examined as to his qualification for such duties by the Inspector of Air Brakes or other person appointed by the proper authority. Every such employé will be required to have in his possession a certificate of competency to perform those duties, which will be given him only after having passed a satisfactory examination.

The issuing of certificates or diplomas in recognition of a special training or service is very well under some circumstances, especially when issued by a limited number of authorized examiners, but we question whether such a promiscuous and general issue of brake certificates as would certainly follow if the managers accept the committee's recommendation, would not be more damaging than advantageous in its results. Such certificates would be treasured up and produced notwithstanding the fact that their holders in all probability have very quickly forgotten important features of the subjects they were examined on. . . . As a matter of fact no carefully managed road would put a trainman to work on the production of certificates. . . . For these reasons, together with legal complications which might arise in case of the non-holding of certificates, we do not indorse this recommendation.

We will at once take up the question of mininum and maximum limit of piston travel, which is placed at 4 and 8 in. respectively for tank brakes, passenger equipment and freight equipment. In lieu of these figures we recommend substituting 6 and 9 in. wherever they appear throughout the rules. The evident object of the committee is a good one, viz: that of restricting the piston travel within the limits of 4 in. We must, however, consider hard practical facts of service, and we believe you will agree that such figures will in reality result in a piston travel of from 4 to 12 in. (full stroke), or a variation of 8 ins. If 6-in. minimum was adopted the possible figures would be from 6 to 12 in., or a variation of 6 in. between minimum and full stroke, which would be a 2-in. gain over the Committee's figures.

In determining the minimum travel, however, there is another feature that must not be lost sight of. The leakage groove in the brake cylinder is 4 in. long; the piston is 1 in. thick. It therefore requires about 3½ in. piston travel to cover the leakage groove. If with an emergency application the piston only travels 4 in., in making service stops with such limited travel the probability is that the piston would not cover the leakage groove, would result in a great waste of air and might prove serious in the case of passenger trains, especially on lines where the practice is to pass complete trains through the shop, and which would, in all probability, have the brakes of each car adjusted to the minimum travel. The Western Railway Club at its May meeting recommended a 5-in. minimum travel for freight car brakes. The revised M. C. B. rules under paragraph 19 of rule 3, stipulates a minimum travel of 4 in. We believe further consideration of this subject will result in increasing this minimum limit.

Now let us consider the instructions to the various classes of employés, commencing with enginemen. Paragraph 5 reads:

After the engineer is satisfied that there are no serious leaks in the train, he will, at a signal from the inspector or trainmen, apply the brakes and leave them so applied until the brakes on the entire train have been inspected and the signal is given to release.

We would recommend inserting in the third line after the words "apply the brakes" the following, "by exhausting all the air from the train pipe." This is important for several reasons:

1st. One or more cars, on account of sluggish or dirty valves, may not work on a partial reduction of train pipe pressure, and would consequently have their brakes cut out and be unavailable for emergency service, which would not be the case were all the air exhausted in testing.

2d. In letting all the air out of the train pipe engineers learn to gauge the length of their brake train, and determine whether they are working with a long train pipe or a short train pipe.

. . . When the practice in testing brakes is to exhaust all the air from the train pipe the engineer soon learns to approximately tell by sound the length of his train pipe, a very important consideration and which may sometimes save serious accidents.

On page 4, paragraph 2 reads:

With freight trains which are only partially equipped with the air brake, great care must be used to apply the brakes with only from six to eight pounds reduction, and to allow the slack of the train to be taken up before further application is made, in order to prevent shocks, which otherwise may be serious.

This is surely wrong; the more correct method is to let the slack take up first and then apply the brakes. We would advise the same change on page 25 in answer to question 30. The next paragraph says:

In making a service stop, ALWAYS RELEASE THE BRAKES A SHORT DISTANCE BEFORE COMING TO A DEAD STOP, except on heavy grades, to prevent shocks at the instant of stopping. Even on moderate grades it is best to do this, and then, after release, to apply the brakes lightly, to prevent the train starting, so that when ready to start, the release will take place quickly.

This, of course, refers to a train completely braked, and perhaps it would be well to so specify it inasmuch as the preceding paragraph has reference to partially equipped trains and the instructions would not be applicable in the latter case. If some of the handbrakes were set on the rear car the observance of such instructions would be almost certain to pull the train apart.

The instructions under "Brakes applied from an unknown cause," at the bottom of page 4, are very clear and explicit, and the following should be rigidly lived up to:

If, however, the brakes go on suddenly, with a fall of the black pointer, it is evident that (*a*) a conductor's valve has been opened, (*b*) a hose has burst or other serious leak has occurred, or (*c*) the train has parted.

In such an event place the handle immediately in position 3, to prevent the escape of air from the main reservoir, and leave it there until the train has stopped, the brake apparatus has been examined and a signal to release is given.

On page 5, the second paragraph of the clause about "Cutting out brakes" reads:

When necessary to cut out either driver or tender brake, on account of defects, it shall be done by turning the handle of the four-way cock in the triple valve down, to a position midway between a horizontal and a vertical position.

We would add to this "and leave the bleed cock open." At the bottom of page 7 we find the following:

No passenger train must be started out with the brakes upon any car cut out, or in a defective condition, without special orders from the proper officers. At points where there are no inspectors, trainmen must carry out these instructions.

We would advise adding "as far as is practicable.' Trainmen have to be allowed a certain amount of discretion, and there is hardly a road but that has passenger trains at points where it is impossible to make air brake repairs and equally impracticable to communicate with the proper officers for advice.

The paragraphs on page 8 about brakes sticking, train breaking into two or more parts, and cutting out the brake on a car, are specially commendable. The last four lines under "Brakes Sticking" reads:

The release may be effected by opening the small cock in the auxiliary reservoir, until the air begins to release through the triple valve, when the reservoir cock must immediately be closed.

It is very important that as soon as the air begins to escape through the triple the bleed cock be immediately closed, for if left open for any length of time it might apply brakes on other cars in the train. The last 2½ lines on top of page 9 of the paragraph about "Cutting out the brake on a car" is also specially commendable, and if carried out would aid much in maintaining the efficiency of the brakes. It reads as follows:

When it is necessary to cut out a brake the conductor must notify the engineer and also send in a report stating the reasons for so doing.

Further down on page 9 we find:

BURST HOSE—In the event of the bursting of a brake hose, it must be replaced and the brakes tested before proceeding.

We would add to this "providing the train is in a safe place."

At the bottom of page 11, under "Instructions to engine-house foreman," we find:

DRAINING—The main reservoir must be drained of any accumulated water after each trip, and the drain cup in train pipe under the tender frequently. The auxiliary reservoirs and triple valves must also be frequently drained, especially in cold weather.

We would like to see this changed by erasing "and the drain cup in train pipe under the tender frequently," and inserting "and the train pipe under the tender must always be blown out thoroughly before connecting with the train." This is very important. The dirt, oil and grease from the pump, and the sweat and rust from the pipes while the engine is in the roundhouse, all collect under the tank, and, unless the above precaution is taken, will be blown right into the first car connected to. The result of neglect in this matter is clearly seen by comparing the triple valves on baggage cars with those on Pullman cars. Let any man who doubts this place his hand over the tank hose and then blow the pipe out. The dirt he will catch will be very convincing.

Question 40 reads:

40. Q. How much pressure can be obtained in the brake cylinder by the ordinary application of the brakes with 70 lbs. in the auxiliary reservoir?

A. About 50 lbs. to the square inch.

We would add to the reply "with 9-in. piston travel." Tests that we have made with service application and an auxiliary pressure of 70 lbs. give the following figures:

4-in. travel 58 lbs.
5-in. travel 56¼ lbs.
6-in. travel 54½ lbs.
7-in. travel 52⅞ lbs.
9-in. travel 49¼ lbs.

On page 22, question 66 reads:

66. Q. How should the air cylinder of the air pump be oiled; what kind of oil, and why?

A. It should be oiled very little, by once filling the oil-cup with West Virginia well oil daily. The oil must never be introduced through the air inlet ports, as this practice would cause the valves to gum up.

The above answer is a very important one, especially the last two lines. Enginemen frequently allow the air inlet ports to suck up the grease. Not only does such practice gum up the valves, but the grease works back to the engineer's valve and often closes the preliminary exhaust port.

On page 24 the questions and answers 74 to 76 are all very important, and should be carefully studied. The reply to Question 89 on page 26 is not quite as clear as it might be. The question reads:

89. Q. Are the brakes liable to stick on after an emergency application, and why?

A. The brakes are harder to release after a severe application, because they are on with full force, and it requires higher pressure than usual in the train pipe to release them again. In this case it is necessary always to have in reserve the excess pressure on the main reservoir to aid in releasing the brakes. With the quick acting triple valve this is especially necessary, because air from the train pipe, as well as from the auxiliary reservoir, is forced into the brake cylinder when a quick application of the brake is made, *thus increasing the pressure in the brake cylinder, and requiring a high pressure in the train pipe afterward to cause the brakes to be released.*

I have italicized the last three lines. The inference from that portion of the reply is that the cylinder pressure only has to be overcome to release the brake. It would seem to the writer to be more correct if the reply left the impression that auxiliary pressure also had to be overcome. The air from the train pipe having gone into the cylinder there has been less drain on the auxiliary reservoir, and consequently a higher pressure to be overcome in the auxiliary reservoir than if the air had been taken from that reservoir alone. To insert "without the usual reduction in the auxiliary reservoir" would seem to remedy this matter. The explanation would then read: "Thus increasing the pressure in the brake cylinder without the usual reduction in the auxiliary reservoir, and requiring high pressure in the train pipe afterward to cause the brakes to be released."

On page 30 we think some further consideration should be given the brake in two questions. No. 113 reads:

113. Q. If a hose bursts upon the run what must be done?

A. The hose must first be replaced by a good one, and the engineman then signaled to release the brakes. The train must not proceed until the brakes have been reconnected and tested upon the train to see that all are working properly.

We would preface this answer by saying "If the train is in a safe place —— —— —— etc., etc." We would also add another question and reply as follows:

Q. If a hose bursts and the train is not in a safe place, what must be done?

A. Shut the stop cock immediately ahead of the burst hose, signal the engineer to release the brakes, release the rear brakes by bleeding the auxilary reservoirs and proceed to a safe place to connect and test the brakes as provided in Q 113.

In the reply to Q. 114 we think the last three lines, which we have italicized, might be crossed out.

114. Q. If the train breaks in two, what must be done?

A. The cock in the train pipe at the rear end of the first section must be closed, and the engineman signaled to release the brakes. The two parts of the train must then be coupled, the hose connected and the brakes again released by the enginman. *After the train has been completely coupled up and the brakes are released, all brakes must be tested before continuing the run.*

We would also recommend inserting the following instead of the italicized clause:

"This is evidence that the brakes are in proper working order, and the train may then proceed."

We believe all will concede that in case of a break in two when all the hose has been recoupled and all the brakes thrown off by the engineer it is equivalent to a test of the brakes, and any further test is only an uncalled for delay.

In the answer to Q. 116:

If the brake of any car is found to be defective on the run, how should you proceed to cut it out?

A. By closing the cock in the crossover pipe of the quick acting brake, or in the triple valve of the plain automatic brake, and then opening the release cock in the auxiliary reservoir *upon that car until all the air has escaped from it.*

We recommend omitting the line which we have italicized and inserting "and leave it open." This will prevent any accumulation of air in the auxiliary reservoir which may pass through leaky or defective cocks.

DISCUSSION.

President BARR: I think that in addition to any discussion that we may have this afternoon, there should be a motion made that it is the sense of this meeting that all air brake experts connected with the different roads interested in this club should be requested to be present at the next meeting for the purpose of discussing this paper. Mr. Barr's suggestion was followed, a motion embodying it was offered and carried; and upon motion of Mr. MacKenzie it was further voted that experts from the different brake companies be also invited to attend and participate in the discussion.

There was considerable discussion of the certificate clause, which we omit entirely.

Mr. RHODES: The next matter that I have questioned is the length of the piston travel; the minimum recommended by the Committee is 4 in. and the maximum 8, and our car builders' rules have adopted those figures this year.

President BARR: As I understand it, Mr. Rhodes, you consider that the minimum should be 6 in. and the maximum 9.

Mr. BARNES: This is probably the most important recommendation to make in the rules. I have heard a great many discussions about it outside, and I think it will be well for Mr. Rhodes, if willing, to expound particularly why he recommends what he does.

Mr. RHODES: Perhaps it might have been well if we had had a shop practice specified here as well as a road practice. I have assumed that the shop practice will be 4 in. and that the road practice will be the maximum, or 8 in. As a matter of fact, we know that in actual work the maximum will be full stroke, 12 in.

(*Continued on page 711.*)

* Abstract of a paper by Strickland L. Kneass in the *Proceedings* of the Engineers' Club of Philadelphia. Vol. VIII., No. 3.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

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Appreciation of the value of the block system is increasingly manifest in various quarters, and announcements of its adoption on a few roads within the last year will be recalled by our readers. We print in another column of this issue a description of the way it is operated in one of the most interesting of these installations. There is little doubt that with the same degree of care on the part of the dispatchers, operators and trainmen, a system like that described to-day is decidedly safer than the ordinary "American dispatching system," notwithstanding the existence of switches which the operator does not control and which have no interlocked signals; and the only question is, whether the additional expense involved is warranted, when, after all, many of the trains must be run under "permissive" signals. Men who insist that there is no merit in anything by the name of block system, except the absolute system, say keep your money and make no radical changes until you can work the absolute system. Without stopping here to remind them that even a perfect block system as they (at least most of them) describe it is still far from perfection on account of the switches that they consent to leave unprotected, we may answer that in practice the difference in cost between what they would have and what the Erie and other roads now do have is generally so great that there is no use in arguing about saving money for the future; the time required to accumulate enough is too long. Moreover most directors who have never spent money for block signaling need more or less teaching by object lessons and a permissive system serves very well for that purpose, whereas the moment we go beyond and insist on absolute blocks for all trains the cost jumps to enormous figures. Take, for instance, the schedule we print to-day. Three fast freight trains ready to leave Akron at 4:20 a. m., can, by going five minutes apart, reach Tallmadge in time to meet passenger train No. 1 due there at 4:41; but if an absolute block were insisted upon the second and third freights would be hindered 30 minutes or more, an intolerable delay. The only alternative is to establish additional stations, costing at least $1,000 a year; and as numerous other blocks would have to be cut up in the same way the required total outlay at once becomes prohibitive. But, without arguing further about freight trains, it is not too much to say that the possibility of being able, at any time, without previous preparation, to block any number of passenger trains absolutely, is one of the chief advantages of a system like the Erie's. To issue a lot of special orders every time two or three excursion trains are run, and spend a lot of time and energy telling operators that they must "brace up" for the occasion, looks too much like admitting that ordinarily the lives of passengers are not so scrupulously cared for, and creates a bad impression—or will do so if the public continue to grow more critical. It has been said that the least that any railroad can fairly do is to have enough telegraph offices and night operators to absolutely block its freight trains during every protracted fog or storm, and to absolutely block, at any time, as many passenger (excursion) trains as there is any likelihood that its traffic department can get passengers for. Why is not that a pretty fair standard?

Rapid Transit in New York.

We need not apologize for the great space given in this issue to the reports on the construction of the underground rapid transit railroad for New York City. This is an engineering problem of the first magnitude. The strictly physical part of the problem, that is the actual construction of the railroad, is formidable. The ground to be gone through is very bad. From Front street to Thirtieth the rock is from 10 ft. to 163 ft. below the surface; from Rector street to Third it is everywhere more than 60 ft. down. On this rock lies sand which in many places, and for considerable distances, is almost quicksand when dry and when wet would run like water. This precarious ground is loaded with heavy buildings, the foundations of which are often very shallow. Trinity Church, for instance, on the Broadway side, has a foundation but 9 ft. 4 in. below the sidewalk. At various points, however shallow the subway, it must go below tide level.

But formidable as the physical element of the problem is seen to be, the business element is even more serious. It is extraordinarily big and complex. Necessarily the cost must be very great, and the amount of the investment alone makes the matter one of great importance. Further than that, it is by no means certain that interest on the investment, even with the most judiciously selected and carefully constructed system, can be earned. This element is one of such uncertainty and importance that it is necessary that the line be so laid down and the stations be so placed, not only with reference to the districts to be served but with regard to convenience of access, that the line will be as attractive as possible. The new routes will have to compete with the very efficient service of the elevated roads and with the rapidly improving service of the cable and horse-car lines. It is absurd to suppose that the long-distance travel which can be diverted from the existing elevated roads will be sufficient to pay interest on the investment. On the contrary this can be but a small part of the necessary total earnings. Therefore the line must be so laid and constructed as to make it attractive to those going compartively short distances. It must be handy to get at, and attractive when reached, and the speed must be at least as great as that of the elevated trains. In fact, if the long distances are not made in better time than they are now made by the elevated, the new route will be a partial failure.

But the motor, other than a steam locomotive, which will take trains as heavy as are now run on the elevated railroads of New York, and haul them at 35 miles an hour, has not been built yet; it probably can be built, but it has not been. Further, the means of ventilating a tunnel constantly filled with persons has not yet been developed. Of this we shall have a word to say later; it is enough to make the statement here. Considering all these facts, our assertion at the outset that the engineering problem is one of the first magnitude is moderate enough.

It is not surprising, therefore, that there should be wide differences of opinion among the experts who report upon it, or that the Commission should proceed with great deliberation. It is only given to some superior intelligence, like, for example, the New York *Evening Post*, to be cock sure on the subject. That journal asks from day to day why the engineers of the Rapid Transit Commission have not mentioned the "Greathead system," and wonders at the almost total absence of any allusion to it in the reports of the experts. This "system," we are told, is an absolute solution of this most complex problem. We are assured that "it would furnish a means of transit in which good ventilation, speed, safety and comfort would all be supplied as natural concomitants of the system. . . . It can be constructed with almost equal ease through rock or clay or any other natural barrier."

We have long suspected that the *Post* does not know the "Greathead system" when it sees it, and have endeavored to get that journal and some others to define the "Greathead system." Now we are certain that it does not know what it is talking about. For example, it says that "Mr. Cooper, one of the consulting engineers, comes nearest to mentioning it [Greathead system] when he recommends that northward, from Twelfth street, in Broadway, for the purpose of safe construction, so as not to interfere with the overlying pipes and mains, the tunnel should be dropped to a depth of 35 or 40 ft., so as to leave 6 to 8 ft. of solid rock between the roof of the tunnel and the pipes and other sub-surface works." Mr. Cooper is no such ignoramus as to recommend the so-called Greathead system for rock work, but he does specifically recommend it for the sandy ground between the Battery and Twelfth street. We must conclude, therefore, that the extraordinary statement that "good ventilation, speed, safety and comfort" are "natural concomitants of the system," springs from the same profound misapprehension that classes rock and clay among the "natural barriers" through which the Greathead system can be constructed with almost equal ease. We refuse, however, to believe that the real spring of the *Post's* knowledge and interest is to be found in the following words taken from its columns: "With the deep tunnel nobody's vaults will be disturbed." We cannot think that this stout expounder of applied morality can be influenced by the possession of a big vault under Broadway.

Doubtless the Rapid Transit Commissioners realize the magnitude of the job they have on hand, and doubtless they have enough moral courage not to be driven to hasty action by cries of "Jay Gould" and "Tammany" and "the Vanderbilts." Their business is to fix on a scheme that can be built by private capital. The franchise, if it is sold at all, must have a good prospect of paying interest. As Mr. Chanute says, the bidders will inquire whether the problem has been solved in the most economical way. And they will ask if the kind of railroad prescribed can be operated economically and can be made so attractive as to draw patronage from its very able competitors. There is no use in offering for bids any half-baked and experimental scheme. It will only cause delay. Real progress will be made by taking time to discover the best solution all elements being considered.

We shall not attempt to decide as between the plans presented by Messrs. Worthen and Parsons, and modified by the four engineers who have reported on them. These plans and reports are now published in such detail that the reader can get a good general notion of the problem and the various solutions, and can begin to think intelligently about them. But we venture to say that the more he thinks the more he will realize the difficulty of the case and the need of most careful consideration. We recommend especially for his careful reading the report of Mr. Chanute. That is a masterly document and will live in engineering literature. In full it would have occupied about two pages of the *Railroad Gazette*, and we only regret that we cannot take the space to print all of it.

The engineers of the Commission and the board of experts were restricted to an underground route. We are not sure that this was wise, but that was the limit proposed. We are inclined to believe that within that limit the Parsons plan, probably modified somewhat, would be the best solution.

A deep tunnel seems inexpedient because of its inaccessibility, if for no other reason. The great volume of short distance travel would probably avoid it on that account, but this traffic must be had if interest is to be earned. It is preposterous to say that the City & South London Subway (Greathead) has proved the success of a deep tunnel for New York. That road carries something less than 15,000 people a day, and carries them in small cars at a very moderate speed; and we are assured by those who have very lately ridden through those tunnels that the ventilation is entirely inadequate. Of the cost of operating this tunnel we have so far no figures of any value. It is assumed that a deep tunnel can be built at a less cost than one near the surface, This is not at all certain. It must either go in the sand as far as Union Square or go to an unreasonable depth; but to carry four tracks through the sub-Broadway sand by an enclosed shield system, might be just as costly as working from the surface and permanently providing for pipes and wires. It must not be overlooked that there must be crossovers, sidings and standing tracks, whatever the depth of the tunnel, and to provide for these in enclosed shield tunneling will be costly.

The great advantage claimed for the Worthen plan is that it can be carried out without disturbing the pavements or pipes, and hence that it will be cheaper for the contractor and for the public. The opinions of Mr. Chanute and Mr. Cooper on this plan of tunneling are very discouraging. Indeed, Mr. Wilson, who indorses Mr. Worthen's plan in general, finds the actual project for construction incomplete. We may suggest further that the success and economy of this plan of construction depends on the use of the existing vault walls, and that a very large percentage of these walls will be found inadequate to sustain the apparatus of construction or the tunnel roof after it is built. If, then, the Worthen tunnel cannot be built as proposed, its great advantage over the Parsons' plan disappears.

Of course there are minor particulars in which one or the other plan is superior. The Worthen

for instance, offers easier means of crossing from local to express tracks, to run around wrecks, etc., but the Parsons' plan gives an excellent chance for middle standing tracks and crossovers between the express tracks. Probably both plans err in making the cars too low, and Mr. Worthen's notion of ventilating the cars by a "regulated admission of air at the front end" has been tried and abandoned over and over again. The fact is that this underground road must be designed for a traffic of extraordinary intensity. It must have such a traffic to pay. That is, the cars will probably be kept in more constant circulation than on any ordinary surface railroad; they will be run fuller of people and at nearly as high speeds. Therefore they should really have more cubic feet of air space per passenger carried, and should not be inferior in accessibility for inspection and repairs. In short, both plans are admitted to be still incompletely worked out, and the review of them by the experts must have already suggested many modifications to the authors. The public of New York city, and engineers in general will now wait with great interest for the next step of the Commissioners. Meantime we advise them not to be hurried.

The New Kentucky Constitution and the Railroads.

With scarce an exception, the State constitutions made in the past 15 or 20 years have been criticised because they have contained more of what is temporary and experimental than what may rightly be deemed organic and essential; but the constitution recently adopted by the people of Kentucky goes farther in this respect, perhaps, than any other. It is crowded with provisions purely legislative in character, and which, if really necessary, had very much better have been put in the form of statutes.

The framers of this instrument seem to have directed their efforts almost exclusively to the regulation of corporations and especially of railroads. Almost every method which the fierce prejudice against railroad corporations—so rampant for some years past—has suggested to either shackle or punish them; every device that an industrious examination of restrictive legislation, state or national, could discover, is to be found in the new constitution of Kentucky. The chief aim of its enactment seems to have been to harass, as far as possible, the roads already constructed in that state, and to discourage further railroad construction.

It may be that an instrument, so extreme and virulent, will defeat itself, and it is to be hoped that it will be construed and executed in a very different spirit from that in which it was conceived and formulated; but it impresses the reader as having been designed to impede the uses, hinder the best service and impair the properties of the rail carriers so unfortunate as to be doing business in Kentucky. This expression of intolerance of corporate enterprise and agencies is the more to be regretted as coming from a people heretofore regarded as exceptionally conservative in all matters relating to proprietary rights, and who have certainly received large benefits from capital invested among them, in the belief that it would be fairly treated.

Kentucky has always until now scrupulously respected "vested rights," and her courts have adhered closely to the doctrine of the Dartmouth College case, treating every admitted legislative contract as inviolable. When her General Assembly passed the statute known as the "Act of 1856," that "All charters or grants of or to, corporations, or amendments thereof, enacted or granted since the 14th of February, 1856, and all other statutes, shall be subject to amendment or repeal, unless a contrary intent be therein plainly expressed," it was provided "that while privileges and franchises so granted may be changed or repealed, no amendment or repeal shall impair other rights previously vested." Nevertheless, the new constitution declares that any corporation, without distinction, in existence at the date of its adoption, shall be deprived of the benefit of future legislation, unless it file an acceptance of the provisions of this constitution in the office of the Secretary of State. The Federal Courts will doubtless treat this provision as inoperative, so far as it affects corporations created prior to 1856; but it was unquestionably aimed at such corporations, and illustrates the animus of the authors of the instrument.

It is surely not asking too much that an organic law shall be couched in ordinarily intelligible terms. Whatever difference of opinion there may be about the policy and propriety of its provisions, their meaning should be clearly expressed and unmistakable. But this cannot be claimed for the instrument we are discussing. The language of some of its most important sections is extremely obscure. It is provided, for instance, that

> no corporation shall issue stock or bonds except for an equivalent in money paid or labor done, or property actually received and applied to the purposes for which such corporation was created, and neither labor nor property shall be received in payment of stock or bonds at a greater value than the market price at the time said labor was done or property delivered, and all fictitious increase of stock or indebtedness shall be void.

It is not easy to determine exactly what this section means. It seems to have been the intention of those who framed it to fix the market price of "labor done," or "property actually received" in payment of stock or bonds, at the time of performance or delivery, as "an equivalent" therefor; yet, if money be paid for said stock or bonds, the sum so paid must also be "an equivalent," and no criterion, like a "market price," is provided by which may be measured the equivalence of the money. It is quite clear that an issue of stock or increase of indebtedness shall be held "fictitious," if payment therefor be received in labor or property, at a greater value than the market price then ruling; but if it be impossible to determine what is "an equivalent" in "money," a very little labor or property, even at "market prices," may go a long way. But a far more serious objection than this ambiguity is the uncertainty in which such a provision will involve all securities to which it will apply. Who will be willing to buy Kentucky stocks and bonds, if he must previously be sure that, although issued years before he touches them, they have been paid for in an equivalent of money, or labor, or property, and that the equivalent was actually received and applied to the purposes of the corporation, and that there has never been an issue of stock or increase of indebtedness paid for in labor done or property delivered at a greater value than the contemporary market prices?

The article entitled "Suffrage and Elections" contains this provision, which we believe has never before been incorporated in any constitution, or, indeed, enacted in any form:

> If any corporation shall, directly or indirectly, offer, promise, or give, or shall authorize, directly or indirectly, any person to offer, promise, or give any money or anything of value to influence the result of any election in this state, or the vote of any voter authorized to vote therein, or who shall afterward reimburse or compensate, in any manner whatever, any person who shall have offered, promised, or given any money or other thing of value to influence the result of such election or the vote of any such voter, such corporation, if organized under the laws of this commonwealth, shall on conviction thereof, forfeit its charter and all rights, privileges and immunities thereunder; and if chartered by another state and doing business in this state, whether by license or upon mere sufferance, such corporation, upon conviction of either of the offenses aforesaid, shall forfeit all right to carry on any business in this state.

The absurd injustice of this provision is patent. A corporation can only act by and through its agents. Some of its agents may take part in an election and use improper means to influence voters, and yet do it from purely personal motives, and not with any view at all of obtaining any advantage for the corporation. The money expended may be the agent's own money and not that of the corporation. The act of bribing the voter may be dictated by reason or desire with which the corporation has no concern. Nevertheless, if it be alleged in the indictment that the agent did influence the voter with the view of aiding the corporation, the average juror will believe it. The individual will escape deserved punishment, and the innocent and unconscious stockholders will be made to pay the penalty. The courts may indeed hold that the agent, in bribing voters or taking part in elections, acts *ultra vires* and cannot make the corporation liable; but the ignorance or malignity expressed in this provision is most extraordinary.

The long article devoted to "Railroads and Commerce" is, of course, full of matters of like tenor to the examples already given. A railroad commission is permanently established; the only instance, we believe, in which this has been done by constitutional provision. It is declared unlawful for any railroad or common carrier "to charge or receive any greater compensation in the aggregate for the transportation of passengers, or of property of like kind, under substantially similar circumstances and conditions, for a shorter than a longer distance over the same line, in the same direction, the shorter being included in the longer distance." This, too, is novel, as being the first attempt to cut the Gordian knot of the "long and short haul," by a constitutional declaration. The convention which made this constitution was evidently composed of that class of persons who, according to the old proverb, can only learn by experience.

The rolling stock and other movable property of railroad corporations is made liable to execution and sale in the same manner as the personal property of an individual; and their earnings, choses in action, etc., under the control of any officer or agent, "shall be subject to process of attachment and garnishment to the same extent and in the same manner as like property in the hands or under the control of other persons."

The courts of Kentucky have heretofore held that taking railroad property, under execution, and attachment of money in the hands of the agents of such corporations, should not be permitted on the grounds of public policy. In order that the public interest and its use of such property might be preserved, undisturbed, they have treated "a railroad and all of its appurtenances as one entire thing, not legally subject to coercive severance or dislocation;" and recognizing that the convenience and use to the public of carriers transporting passengers and freight throughout the state, constitute the consideration for which are granted their corporate privileges, that their continued and convenient use for purposes of trade and commerce is demanded by the public interests—they have refused to permit the income of the road to be appropriated to the payment of its debts in proceedings to attach or garnishee, for the reason that, to thus deprive the corporation of the means of paying its employés and current expenses, would endanger the rights of the public by preventing transportation. "The appropriate remedy in such a case," the courts have said, "is by application to a court of equity, seeking a discovery as to the condition of the company; and upon the failure of the chief officer or officers to pay when directed, they may be imprisoned for contempt, and the chancellor will take possession of the road by placing it in the hands of a receiver, and apply the net income or any surplus fund to the payment of the creditor's claim."

Experience will very soon vindicate the wisdom of the old rule. Doubtless some of the railroads may be harassed and their service to the public very largely impaired; but levying an execution on railroad rolling stock will prove a delusive remedy to the individual creditor. He can make little use of a locomotive or a box car, and it must be sold, also, subject to the inevitable mortgage or mortgages which every railroad carries.

This same article, also, contains provisions which virtually enable any railroad which makes a physical connection with another, to use the terminal facilities of the latter upon terms of perfect equality.

"No common carrier shall be permitted to contract for relief from its common law liability," is a provision in the article on corporations, which may in practice be found more obnoxious to the shippers than to the railroads.

Taken all in all, this instrument may be regarded as an expression of every phase of sentiment inimical to corporate property.

The report of the Secretary of the British Iron Trade Association, Mr. J. S. Jeans, for the first half of this year, is published in the English technical papers of the 25th ult. His amounts are: Praduction of pig iron, 3,812,787 tons; Bessemer steel ingots, 1,055,280 tons; steel rails, 97,364 tons; open hearth steel, 753,572 tons. A substantial decline is noted in all of these products except the last, which shows an increase of 25,316 tons. The production of pig iron in the two countries by half years has been as shown below, in gross tons:

	United States.	United Kingdom
1st half 1890	4,560,513	4,168,464
2d " "	4,624,190	3,706,666
Total for 1890	9,202,703	7,875,130
1st half 1891	3,371,925	3,812,787

The production of Bessemer steel ingots by half years has been:

1st half 1890	1,822,535	1,055,280
2d " "	1,866,336	959,563
Total for 1890	3,688,871	2,014,843
1st half 1891	1,427,764	923,005

Of the British production of Bessemer steel 187,477 tons was basic, the rest acid. No basic Bessemer steel is reported for this country.

The production of Bessemer steel rails was as below:

	United States.	United Kingdom.
1st half 1890	922,016	510,459
2d half 1890	875,473	509,147
Total for 1890	1,797,490	1,019,606
1st half 1891	517,794	423,934

The decrease in the British production of pig iron as compared with the first half of 1890 was 355,677 tons, as against a loss in our production of 1,188,588. Her loss in steel ingots was 132,275 tons and ours was 394,771, and in steel rails the British loss was 86,525 tons, as against a loss of 404,222 tons on our part. In both countries the prices have been low, though not as low as at previous periods of depression. It will be noticed that the English boom was evidently running out strongly through all of the last half of 1890, whereas it was only in the last quarter of that year that our production began to decline, our make for October having been the largest in our history. When it commenced, however, it went rather faster than the English boom; but our production has probably taken a turn for the better quicker than the English, for in July and August we were making rather more iron than a year ago, and without any increase in price. A turn for the better in the affairs of British iron masters has just taken place through the insecurity

of a large number of bridges on the principal railroad lines. The *Iron Trade Circular* says: "The duty of railway companies to replace many of their old cast iron bridges is, as we have before pointed out, having its effect upon the iron trade, and to some extent is making up for the falling off in our trade with the Argentine Republic. To this great demand for new bridges it is not difficult to attribute the late rise in the price of iron and steel, and probably we are right when we say that that is the cause of the constructive kinds of iron and steel going up." The rise so far seems to be about five shillings per ton. And it may be of interest to bridge builders to know that a *Circular* thinks it will soon be difficult to place an order for a bridge anywhere. This seems to open an opportunity for business to any firm of American bridge builders that would buy its material in England, and so insure local influence for its bid.

We noticed last week the fact that the London, Brighton & South Coast has adopted the Pintsch gas system as its standard for car lighting after a considerable trial of electricity and other methods of lighting. Of course it is well known that this system is making rapid advances in the United States, and we have always held that with the multiplication of plants the advance of the use of Pintsch gas would be increasingly rapid. It appears to be true that as the means of recharging tanks are multiplied through the country the disposition to equip for lighting by this system becomes much greater. We hope that it will not be long before it is used largely on street railroads and on the elevated roads of New York. The number of persons whose comfort and happiness is concerned in the conveniences of street car and elevated railroad travel is immense. In the city of New York alone there are about 1,200,000 rides taken every day on the lines of city travel and by the Brooklyn bridge. Allowing two rides to each person, this gives 600,000 people a day in New York City alone who are interested in having clean, comfortable, bright and well ventilated cars. The number of passengers carried per day in the whole United States, on the steam railroads, leaving out of account the elevated railroads of New York and Brooklyn averaged in 1890 about 1,420,000. It will be seen therefore that so far as human comfort goes it is quite as important to light street cars well as steam railroad cars. The company which controls the Pintsch patents in the United States is constantly improving its apparatus. Experiments have recently been made with lamps having five and six burners, and the results obtained with the five-burner lamps are extremely satisfactory.

It is a fact well known to some, that the theoretical and the actual performance of safety contrivances on railroads are two different things. It is very easy to sit at one's desk, and be cock sure that any given appliance is going to produce a given result, but it is not so certain that in practice it will not produce directly the opposite result. This was illustrated a few days ago in the case of a butting post put in advance of a bridge truss. The bridge was for four tracks, having five trusses. A train going west was derailed, a car was piled against the butting post, making a pathway for following cars to climb up over the post and strike the end post of the truss between the westbound and eastbound tracks. Two or three cars took this path, then cars still further in the rear were deflected across the eastbound track, and took out two or three members of the outside truss on that track. What would have happened in this case if there had been no butting posts, of course nobody can tell, but it is quite apparent that matters could not have been worse than they were.

NEW PUBLICATIONS.

The Corporation Problem. By William W. Cook, of the New York Bar. New York: G. P. Putnam's Sons. 1891. Pp. 262, 12mo. Index. $1.50.

Every thoughtful mind interested in the larger public questions of the day will welcome any contribution to the solution of the "corporation problem," but Mr. Cook's little book will be somewhat disappointing if one expects to find in it anything particularly new or suggestive on this subject. To those who have given time and thought to the problem, it gives little or no assistance. Viewed from a literary standpoint the work is excellent, and Mr. Cook is certainly to be commended for the honesty and fairness of his statement of the case. He casts up the arguments, *pro* and *con*, so justly that one cannot decide exactly on which side Mr. Cook stands unless he chooses to tell, and a lazy reader will often be vexed that the question is not decided for him.

In his introductory chapter the author notes the rapid rise of corporations, and finds their growth the necessary result of the great enterprises of modern times. Pointing out our dependence upon these artificial beings, and the good and the evil of them, he concludes that "the days of irresponsible, reckless and dishonest management of corporations are passing away." This is certainly comforting, and we trust it may be true; but we may be pardoned if we confess our belief that this passing away extends a good long distance into the future. The body of the discussion is devoted to the various controversies to which corporations have given rise, remedies for the railroad problem, corporations as the owners of natural monopolies, trusts, and the relations of corporations to the Republic.

The author thinks that the most important struggle between railroads and the public has been over railroad charges. He thinks the old theory that the law of competition will induce railroads to reduce their rates has been exploded, because railroads are natural monopolies and competition between them is an unnatural and therefore transitory state. Another plan to reduce rates by limiting, through charter or statute, dividends on the stock to a fixed percentage, has also proved futile. But reducing rates, by statutes directly or by commissions armed with the power by the legislatures, the author very correctly finds more efficacious. It is true the railroads long and bitterly resisted these enactments as unconstitutional. But when the litigation reached the Supreme Court of the United States, that tribunal did not find the famous Dartmouth College case an obstacle in the way of approving such legislation as constitutional.

The development of judicial opinion on this general subject, by the way, is interesting. Starting from 1873, the court approved an Iowa statute requiring the railroad companies to fix their rates in a certain month annually, have them printed and remain posted during the year, and forbidding the charging of higher rates than those posted. The court noted that no attempt was made to control the rates that may be charged; it was only required that the rates should be fixed, made public and honestly adhered to. Three years later the power of the legislature to control rates was very clearly recognized. Even where the charter of the company authorized it to fix such rates as it should deem reasonable, the legislature of Wisconsin was held to have the power to prescribe a maximum charge for transporting persons or property within the state, or taken up outside the state and brought within it, or taken up inside and carried without. Nor were the companies allowed to recover by action a greater rate than that fixed by statute, even though they proved that the amount charged was no more than reasonable, and in no event in Minnesota could the companies recover more than a reasonable compensation. The following year it was held, in a case coming up from Virginia, that a municipal ordinance prohibiting a railroad from driving or propelling cars by steam through a street that had been for many years so used by the company did not impair any vested right of the company nor deprive it of its property without due process of law. A case from Connecticut 10 years ago settled the principle that under the law of that state railroad commissioners had no authority to bind the state by contract not to exercise its legislative power in a stated way. In 1883 the court seemed to indicate the trend of the future decisions when it laid down the principle that grants of immunity from legitimate governmental control are never to be presumed, for, three years later, the railroad commissions, with the power of preventing the exactions of unreasonable and discriminating rates, were held to be validly created. And last year, while finding an act of Minnesota which provided that the rates fixed by a railroad commission shall be final as to what are equal and reasonable charges, to be unconstitutional, as depriving the Chicago, Milwaukee & St. Paul of its property without due process of law, the court held the state made no irrepealable contract with the company that it should have the right for all future time to prescribe its rates, free from all legitimate control. The company at least had the right to produce evidence of what was equal and reasonable.

The author's reflections on "watered" stock and bonds, discriminations between individuals and towns, rebates and secret rates, free passes, pools, railroad wars, foreclosures and municipal aid to railroads are not especially valuable.

When he comes to what he calls "the remedies for the railroad problem," we are a little puzzled to know what is meant by a "remedy for a problem." The terms illustrate a certain confusion of thought on this subject. After considering state socialism, state ownership and state leasing of franchises as ineffectual means of correcting corporate abuses, attention is given to consolidation; and here the author says: "Railroad consolidations are inevitable. Constitutional and statutory prohibitions cannot prevent them. They are due to the certainty of increased profits and to the impossibility of maintaining competition among natural monopolies. They are the product of the laws of trade, and the laws of trade are stronger than the laws of men. . . . Consolidation is the only available solution of the railroad problem." But the author himself admits that by consolidations "railroad rates will not be reduced, nor will issues of watered stocks and bonds be prevented, nor will the conveniences of trade be studied, nor will the bribery of public officials cease." With these conditions left out, how, in the name of Archimedes, can the railroad problem be said to be solved?

Mr. Cook considers railroads, street railroads, telegraph, telephone, water-works, gas-works, electric lights, irrigation reservoirs, wharves and ferries as natural monopolies, and as to these in general he favors their ownership by municipal governments and the leasing of them to the highest bidder.

A Manual of the Steam Engine. For Engineers and Technical Schools, advanced courses. Vol. I. Structure and Theory. By Robert H. Thurston, A. M., LL.D., Dr. Eng., Director of Sibley College, Cornell University. 8vo., 871 pages. New York. John Wiley & Sons, 1891.

This is an excellent book. It gives in a systematic form the substance of the many papers by Prof. Thurston on the subject of steam engines, and thus really proves a record of the author's literary and scientific work in this special field of engineering.

The distinguishing characteristic of the manual may be said to be the attempt to frame in mathematical form a theory which shall include the wastes which enter into the practical working of steam engines, such as losses by condensation in cylinder due to initial inlet of steam and re-evaporation during exhaust, losses by friction and the like. Furthermore, to give all these factors their due consideration in equations designed to settle the problem: Which is the most economical method of running (steam use) to secure the useful work (horse power) for the least money expense, year in year out, including interest, repairs, depreciation of plant, wages, cost of steam and the like in the analysis?

Chapter I contains an admirable historical account of the development of the steam engine. It is a clear cut narrative and analysis, is good reading and must bring the conviction that Prof. Thurston is unsurpassed as an historian in this department.

Chapter II. "The Structure of the Modern Steam Engine" is an account of the principal structural features of the leading makes and types of steam engines, stationary, marine and others, as built at the present day. It is well handled and the copious illustrations in this chapter (as throughout the book) add to its value. Chapter III. "The Philosophy of the Steam Engine" presents the general principles which underlie the transformation of heat into mechanical work in the engine, showing at the same time the expansion of view steam from the time of Carnot to Hirn. Chapter IV enters the thermodynamics of the steam engine, the heat utilization by transformation as developed by Clausius and Rankine.

Chapters V, VI and VII represent the most interesting portion of the work. In these are detailed the wastes of steam occurring in actual practice, distinguishing the "real" engine from the "thermodynamic," or "ideal" engine; and a painstaking account is given of the results of experiments on jackets, superheating, compounding, high piston speed and the like, and their effects respectively on steam consumption, the expansion curve and the actual commercial economy of the engines. A wide range of experimental data is here covered, evidently collated with much care. All the more are we astonished to find no reference to the careful experiments instituted by Prof. Denton on the Pawtucket pumping engine, in which steam jacketing showed so small a percentage of gain.

Prof. Thurston constructs "curves of efficiency" and formulæ which are designed to cover the actual condensation and use of steam in cylinders with varying ratios of expansion under special conditions of steam use, compounding, superheating, jacketing and the like, but the data at hand are necessarily too meagre and inconsistent to enable such curves and formulæ to be more than approximations. To us it seems doubtful if any special commercial economic problem is not more easily and more accurately solved by accepting the steam uses which the makers of engines will guarantee in everyday competitive practice; all the more because Prof. Thurston does not take into account leakage of valves and pistons, which frequently became so great a disturbing item after a few weeks running of the engine. For instance, theoretically (and according to Prof. Thurston's own figures relating to "real" engines), the high speed electric light engines should present a far better economic showing than the lower speed engines; but still it is a well recognized fact in electric lighting practice, that the high speed is by far the less economic machine, considering yearly results in dollars and cents. Of course, we are aware that it would be quite impracticable to include leakage as a fixed arithmetical factor in an equation, but as a fact it enters as a variable and uncertain, but always important and troublesome, factor in the "real" engine, and, therefore, should have its representation in any equations presumed to cover the case of the "real" engine, as Prof. Thurston defines it, as distinguished from the "thermodynamic" or "ideal." Prof. Thurston's equations and curves possess real interest, but we question, for reasons briefly indicated above, their practical commercial applicability.

It is gratifying to observe that Prof. Thurston sees clearly that the question of method of steam use in an engine must be finally (commercially) answered by the reply to the question: "Does it pay in dollars and cents?" Again, that all items of expense entering the problem besides that of cost of fuel must be considered and have due weight. This is the great theorem established by Rankine, so long overlooked and forgotten, and then finally resurrected and shown in its full significance and import by Wolff and Denton.

Prof. Thurston's elaboration in this department, interesting as it is, would have been seen in a truer light and would have carried greater weight, if Rankine's theorem of commercial economy of the steam engine, so broadly conceived, had not been relegated by the author to the rank of a special case of the several "cases" discussed; but if this theorem had been held up in its true position as the one central solution, broad and big enough to cover all specialization, exemplification and further ex-

tension of knowledge as to actual steam consumptions.

But, in spite of some defects, this book is one of great merit, contains many valuable data, and should find a place in the library of every engineer who is at all interested in steam engineering.

Poor's Handbook of Investment Securities, supplementing "Poor's Manual of Railroads." Second annual edition. New York: H. V. & H. W. Poor, 70 Wall street. 1891. Octavo; pp. 508. $2.50.

It is difficult to say in a few words what this volume contains, it contains so much. The object has been to give in compact form the essential facts about investment securities of all kinds in the United States. The first list is of bond coupons. This gives an alphabetical list of the railroad bond coupons which mature in January and July, giving a very concise indication of what the bonds are and the several places of payment. This is followed by some lists of coupons of city, state, county and township bonds. Then follow similar lists of coupons maturing in February and August, and so on for other months. The next table is of annual meetings and dividends. It shows the dates of close of fiscal year, time and place of annual meeting, time of closing and re-opening of books, agents for registry and transfer, usual date of dividend and where payable, etc. Another table shows the amount of the capital stock of dividend paying railroads in the United States with the rate per cent. paid each quarter for eight years. Still another table gives the dates and rates per cent. of dividends paid by leading railroad companies of the country during the whole of their existence. Another table gives for these railroads very concise abstracts of the data given in Poor's Manual; that is, the amount and kind of indebtedness, cost of road, length of road, traffic statistics, earnings, and results of operation. These tables are followed by others giving information of state and municipal securities. Then follow other tables giving the range of value of stocks and bonds, month by month, for four years, and giving the same information for eight years. There are still other lists and tables of great usefulness.

The Engineering Magazine.—The October issue of the *Engineering Magazine* contains articles on Aerial Navigation, the Keely Motor, Landscape Gardening, Railroad Building in Texas, Marble Quarrying, Modern Gold and Silver Miners, Tornadoes, Wagon Roads, Block Signaling and Decorative Electricity, with the usual editorial departments.

The paper on Aerial Navigation is by Mr. Chanute, who, as is well known, has recently spent a good deal of time in the investigation of this problem. In the last paragraph of his paper he mentions the work of Mr. Hiram S. Maxim. One who is interested in this subject will do well to read Mr. Maxim's article in the October *Century*, which is a scientific and concise, and altogether very admirable presentation of the present state of the art of flying. Perhaps we may with propriety suggest further that the best summary which we have seen of Professor Langley's valuable monograph on Aerodynamics is to be found in the *Railroad Gazette* of Sept. 18.

Proceedings of the Engineers' Club of Philadelphia. Vol. VIII., No. 3, July, 1891.

The *Proceedings* for July contains a handsome phototype of Mr. Wilfred Lewis, the President of the club, together with his inaugural address and papers on the operation of a pumping dredge; on crown bar stays and locomotive springs; on street cleaning in Washington, D. C., on the relative efficiencies of steam nozzles of different forms, on the coal regions of Alabama, and on a scheme for a navigable waterway via the bays and inlets of the Atlantic and Gulf coasts.

Under the title Reference Book are given formulæ for curved dams and for various problems connected with the use of steam, and a table of dimensions of cast iron pipes and their flanges.

Transactions of the American Society of Civil Engineers. July, 1891.—This issue contains a number of papers presented at the summer convention. Among these are Mr. Henthron's paper on the Narragansett Chimney, Mr. Griffin's on Car Wheels, Mr. Thomson's on Water Meters, and Mr. Parsons' on Mountain Railroads. There is considerable discussion also of these papers, and the whole makes a volume of 124 pages, with a good many inserted plates and illustrations.

Annual Report of the New York Produce Exchange. July 1, 1890, to July 1, 1891.

In addition to the charter, by-laws and trade rules of the Exchange this publication contains about 130 pages of statistical tables, giving movements of produce and prices for various years.

The Scientific Publishing Co. announces as in press Dr. Wyatt's work, *The Phosphates of America.* Price $4.00.

TRADE CATALOGUES.

The Buckeye Compound Automatic Cut-off Engine Manufactured by the Buckeye Engine Co., Salem, Ohio.

In this circular several perspective views are given of the Buckeye compound tandem, and line diagrams show this and the cross compound in plan and elevation. A section is given of cylinders and valve gear. These illustrations are followed by about 40 pages of description of the multiple cylinder engines manufactured by the Buckeye Company, with discussion of their economy and performance in general. The publishers state that in issuing this first circular of multiple cylinder engines it is but just to say that this is no new subject with them, or one in which their experience has been confined to a few recent years. They built a compound in 1879 with cylinders 10 in. and 20 in. diameter and 18-in. stroke. This was tested by Mr. George H. Barrus, and showed good performance. Since then they have built many compound engines for a variety of purposes.

Air Brakes in Freight Service.

(*Continued from page 707*).

My object in increasing the minimum is so that in practice the variation between the minimum and the maximum will be small. Then, again, it seems to me that the 4-in. travel is altogether too small on account of the leakage groove. The leakage groove being 4 in. long, and that being the minimum travel, it would seem very plain that when you make a service stop and do not throw on all your pressure, that the piston will not travel 4 in.; it may only travel 3 in. or 2½. The pressure will go on very rapidly, but it will go out through the leakage groove. There are two objections thus raised: one is that it will be difficult to make a good stop; and the other is that you will be wasting large amounts of air, which is a matter to avoid. We know that our engineman are instructed to so handle the brake that they won't waste the air.

President Barr: The rule all through is wrong and the greatest stress should be laid on maintaining an average travel, say 8 in. I do not want to teach our inspectors that if the travel is 4 in. or 8 in., or if it is 6 in. or 9 in., it is all right. I maintain that, with the pistons traveling from 4 to 10 in., you will have great difficulty in throwing off brakes, on account of the varying pressure behind the triple valve. The rule ought to prescribe an average and the inspectors ought to be instructed to maintain that average as closely as possible.

Mr. Rhodes: The next matter that I have referred to is quite an important one, and one on which there is a great deal of argument to be had different from what I have used. I refer to paragraph 5, covering the test application of brakes. My recommendation is to direct the engineer to apply the brakes by exhausting all the air from the train pipe. I give two reasons—first, one or more cars, on account of sluggish or dirty valves might not work and would consequently have their brakes cut out and be unavailable for emergency service, which would not be the case were all the air exhausted in testing. Now, an argument against that would be that these brakes not working when they were tested would be made to work before the car or train left the depot. I would say against that argument that in practice we know that would not be the case. Take, for instance, at some terminal on some of these western roads—for instance at our Council Bluffs or Pacific Junction—and suppose some car does not work—it is the sleeping car say. On testing the brakes the brakes do not apply. We cannot hold that train until that brake can be made to work. Our method is to cut out the brake, and that will be done regardless of what rules you may specify. Now, we may cut out that brake when, had we let all the air go out of the train pipe, the brake might have worked. It would not have worked for service applications but it would for emergency applications, and therefore it seems to me it is better to have all the air exhausted out of the train pipe. Then, again—my second reason—comes the matter of the instruction which the engineers get as to the length of their train-pipe by the exhaust. How would an engineer know how his blower worked if he did not hear the escaping steam? How would he know how much power to apply if he did not hear his exhaust? On account of the crowded condition of the cab on a particular type of engine that we used on our road, we placed the engineer's valve out on the footboard, and on riding over the road the conductors told me about how badly the men worked the brakes on these engines, and one said: "Don't you believe that it is because he can't hear the sound of his exhaust, and therefore does not know how much brake power he is applying?" We find that the same men with the valve located in the cab do very good braking. We endeavor to instruct the engineer to watch the gauge, but as a matter of fact, he does not. He listens to the sound of the air he is exhausting, and I believe that some of the accidents that have happened by the train being cut out back of the tank and back of the first baggage car would be averted had the engineer been trained to pay more attention in testing to the length of his train pipe as indicated by the exhaust of the air in applying the brakes.

The next matter to which I refer relates to the brake application on freight trains, which are only partially equipped with the air brake. My idea is that the practice there prescribed is wrong, and that the more correct method is to let the slack take up first and then apply the brakes.

President Barr: I find that some of the best engineers and train men carry out the suggestions made by Mr. Rhodes by arranging to apply a few brakes at the head of the train by hand before they apply the air brake, which is working exactly in accordance with Mr. Rhodes' idea.

Mr. Rhodes: I now come to a point in my recommendations which one of our members has criticized. The rule says, "In making a service stop, always release brakes a short distance before coming to a dead stop, except on heavy grades, to prevent shocks at the instant of stopping; even on moderate grades it is best to do this and then afterward apply the brakes, etc." I agree that the brakes should be released as specified providing the train is not mixed and there are no hand brakes set on the other cars, because if you have hand brakes set on the other cars and you release the front part of the train, it is very apt to pull the train apart.

Mr. Lewis: I think that this should be largely contingent upon the direction in which the train is going, whether up or down grade. If the train was going down grade I should think it would be objectionable to release the brakes just before stopping, and the reverse would be the case in going up grade.

Mr. Barnes: On one road I know they do not release the brakes but they pull out hard just before they stop, with an open throttle.

Mr. Rhodes: The next point I have taken exception to is the prescribed method of cutting out of driver or tender brake, on account of defects. I would add to this instructions to leave the bleed cock open. Having cut the triple valve off, there might be leakages into the auxiliary reservoir, but by leaving the bleed cock open there would be none.

The next is not a very important matter, but if these rules are to be binding it would seem as though this rule was rather too binding: "No passenger car must be sent out with brakes cut out without a permit from the proper officers." Now, if the trainmen are given no discretion, we might lock up a passenger train on some branch. I have suggested that trainmen be ordered to carry out these instructions as far as practicable.

Mr. MacKenzie: I think that the proposed additional words 'as far as practicable" ought to be qualified by saying something about where the car is in the train. You would not want to cut off the last car nor the second one, if you had not power enough to hold the train.

Mr. Rhodes: Mr. MacKenzie's point is a very good one, I think, and one that ought to have considerable attention. We ought to bear in mind though the difference between cutting "out" a car and cutting "off" a car. Cutting off a car, of course, would be very wrong, if it was a rear car, but cutting out a car I do not think would be so objectionable, even if it was a rear car, because if the train broke in two and the brakes were cut out, there would be still a connection between the rear car and the main portion of the train, and if there should be an accident the brakes would apply on the forward part of the train and it could not get far enough away to cause damage. We have had that question up and we all know the accident that happened on one of the eastern roads last spring on account of that. It is a matter which it would be well to embody in these rules in some way.

The next matter is that of draining, and this is one which, if properly carried out, will aid in keeping the efficiency of the brakes up very materially. The rules say the main reservoir must be drained of any accumulated water after each trip. The auxiliary reservoirs and triple valves must also be drained, especially in cold weather. I would like this changed. The main reservoir should be emptied, and the pipe should be blown out before connecting with the train. The tank pipe is subject to more smut, rust and grease from its proximity to the pump and also from change of temperature by going into the round house.

The next matter I will now speak of is the answer to question 89 as to liability to stick on after an emergency application. The answer goes to explain the order, and the inference that may be drawn from it. The inference from the underscored portion of the reply is that the cylinder pressure has to be overcome to release the brake. This, to a certain extent, is true, but it would seem to me that it would be more correct if it left the impression that it was auxiliary pressure also that had to be overcome. The air from the train pipe having gone into the cylinder, there is a higher pressure in the auxiliary reservoir to be overcome than when making service stops.

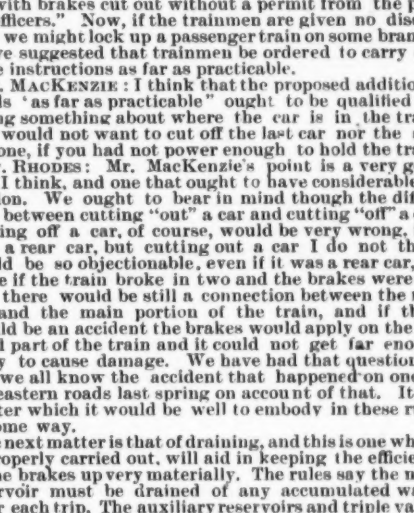
President Barr:—I would like to ask why you say to a certain extent the pressure in the cylinder has to be overcome?

Mr. Rhodes: I say that because during a portion of the travel of the slide valve there is both cylinder pressure and auxiliary pressure on top of the slide valve, but as the slide valve gets higher up, finally it has only auxiliary pressure on top of it. During a portion of the travel of the slide valve there is connection between the cylinder and the auxiliary reservoir.

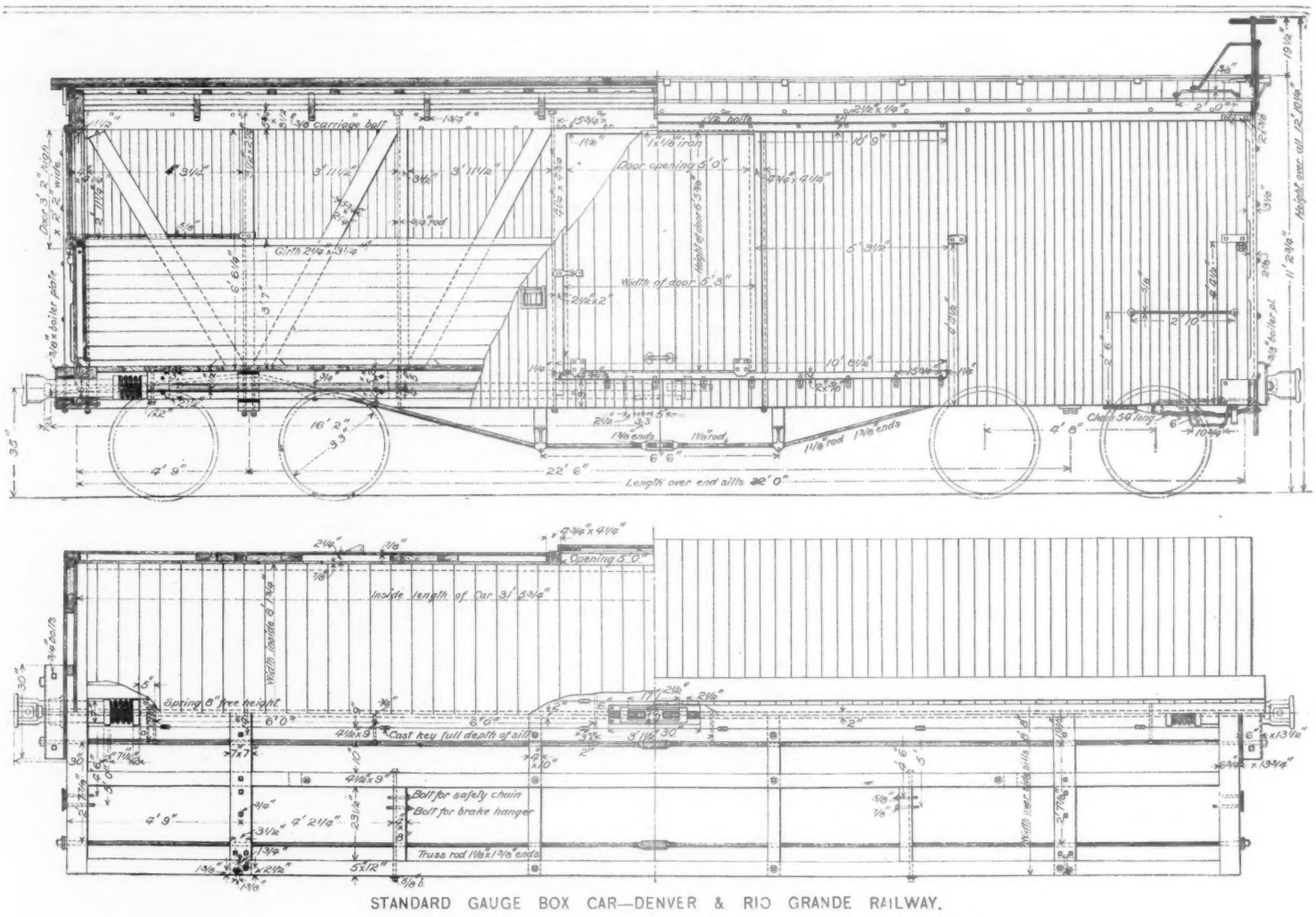
Concerning the answer to question 116, regarding cutting out a defective car. The answer explains the usual processes, and at the end it says, "and then opening the release cock of the auxiliary reservoir upon that car until all the air has escaped from it." Now, it might be inferred that after this is done you are to close it again, and I have recommended that that point be covered specifically and that it read, "and then opening the release cock in the auxiliary reservoir and leaving it open."

Standard Box Car—Denver & Rio Grande.

The 32-ft. box car here shown is one designed somewhat recently by the Denver & Rio Grande for standard gauge service, the growing needs of which are being continually brought under the notice of the traffic department, and it is expected that this car will more fully supply those wants, as its capacity, in bulk, is somewhat greater than that of those heretofore in the service.



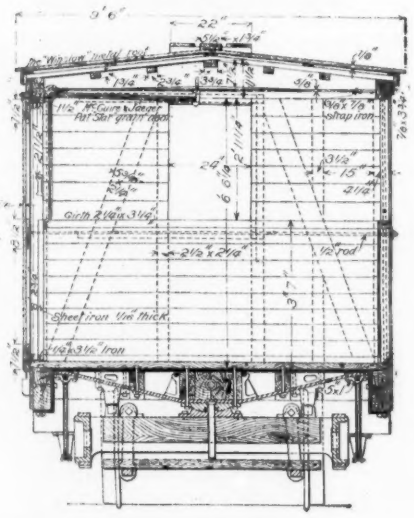
One of the interesting features to many eastern railroad men is, of course, the continuous draught rigging, this principle being used on this road with most satisfactory results. The tail bolt of the draw bar extends back to the middle of the car, where the two (2-in.) bolts are held together by an open link, flat keys being dropped through long drifts in their upset ends. On either side of this rod and between the two centre sills are two 4½ × 8-in. auxiliary sills, between which and the usual centre sills are placed, at intervals, cast keys


Door 3' 2" high x 2' 2" wide
3/8" carriage bolt
Door opening 5' 0"
Height of door 6' 3"
Width of door 3' 3"
Girth 2 1/4 x 3 1/4
1/2" rod
Chain 54" long
Length over end sills 32' 0"
Opening 5' 0"
Inside length of Car 31' 5 3/4"
Spring 8" free height
Cast key full depth of sills
Bolt for safety chain
Bolt for brake hanger
Truss rod 1 1/8" x 1 3/8" ends

STANDARD GAUGE BOX CAR—DENVER & RIO GRANDE RAILWAY.

the full depth of the sills; two inches distant from which are ¾-in. bolts holding firmly together all four sills. In order to get around the difficulty of having the king bolt come up through the floor (as is the usual practice), due to the 2 in. rod being directly overhead, the bolt stops at the lower plate of the transom, the head being recessed half into this plate and half into the centre casting. This leaves but about two inches of this bolt above the truck and obliges practically all the thrust between the truck and car body to be taken by the centre casting, which is held to the transom by two ¾-in. bolts.

The drawbar passes through a cast iron sleeve in the



buffer block and through the end sill. This lowering of the car body necessitates cutting away the lower part of the intermediate sills. An excellent support for the side sills is given by bringing the top tension bar down under that sill and securely fastening them together with one horizontal and two vertical bolts.

Before keying up the drawbar tail bolts one is obliged to compress each drawbar spring ½ in. This takes up all possible play and reduces slack to a minimum, and the direct thrust on the drawhead is taken in line by the auxiliary sills between the centre sills and transmitted to these latter by means of the cast keys, and as these former extend the whole length of the car with the exception of 30 in. at the middle the blow received in kicking the car about freight yards is taken virtually by the entire car frame instead of by four drawbar stops insecurely bolted to a sub-sill, as in the common construction. In hauling a train there is of course the old argument that the tension on the draught springs is simply due to the weight of the one car and is not affected by the number of cars in the train.

The design of the upper framing of the car is similar to that usually followed, the running board extending several inches over at the end. The ladders are copied somewhat from the Pennsylvania and are partially of wood. To increase the power of the handbrakes it has been decided to double the chain back to the end sill over a sheave. The iron brace frame at the wheel on the roof is also adopted. The trucks are of the swing bolster type and the cars are equipped with the airbrake as is the general rule on mountain roads in the West.

TECHNICAL.

Manufacturing and Business.

The capital stock of the Pittsburgh Bridge Co., of Pittsburgh, will shortly be increased from $100,000 to $200,000. Extensive improvements are being made to the company's plant.

The Northampton Emery Wheel Co. at Leeds, Mass., has erected a two story brick building 108 ft. × 45 ft. which it expects to occupy Oct. 15. The building is built upon a foundation of rocks, five ft. deep and covered with cement. The walls are 16 in. thick and the building has a tripple floor. A 15-H. P. engine built by the Fitchburg Steam Engine Co. will be put in, also a 25-H. P. steel boiler. They will also add to their plant a hydraulic press of 2,800 tons capacity, built in England for the United States Government, and used a short time at the Brooklyn Navy Yard. The cap and bed each weigh 25 tons, and the press complete weighs 70 tons. This is probably the largest hydraulic press in the country. The company expects to occupy the building about Oct. 15.

Messrs. Shailer & Schniglau, of Chicago, have recently been awarded the large contract for piling and timber work around the interior water ways at Jackson Park, for the World's Columbian Exposition; they have also been awarded the contract for a 9-ft. tunnel under the Chicago River at Ashland Ave., for the City of Chicago.

Several new improvements have been made in the Clayton air compressors, notably in the patent combined governor, which regulates the speed of the compressor and the pressure of air at the same time and without attention from the engineer in charge. An average of four air compressors per week have been shipped by the Clayton Air Compressor Works, of No. 43 Dey street, New York, during the last two years. These air compressors have been used successfully for aerating crude petroleum for fuel, elevating acids and working pneumatic riveters. There is a large demand for them for this class of work, as well as for mining, tunneling, etc.

The Leland Car Heater & Steam Coupler Co. has received an order from the Lake Shore & Michigan Southern to equip the new cars of that road now building at Cleveland and Adrian.

Iron and Steel.

The new plant of the Lookout Iron Co., at Harriman, Tenn., which has a daily capacity of 80 tons of finished material, has been completed.

It is reported that a settlement of the affairs of the Talladega Iron & Steel Co. will shortly be reached and their blast furnace put in operation.

The Puget Sound Iron Co. has been incorporated at Seattle, Wash., with a capital stock of $1,000,000.

The Riverside Iron Works, of Wheeling, W. Va., are making some extensive improvements at the tube works at Benwood. A new iron building being erected is to be equipped with a new heating furnace to make 14-in. pipe. The largest size now made is 8 in.

The furnace of the Duluth Iron & Steel Co., at Duluth, Minn., which was practically completed about two years ago, but never put in operation, has been leased for five years by Charles Himrod & Co., pig iron dealers of Chicago, Ill., and Crerar, Clinch & Co., and will be in operation this month. The output will be Bessemer pig iron exclusively, for use by the West Superior Steel Works.

The Pennsylvania Steel Co. elected the following board of directors this week: Luther S. Bent, President; Eben F. Barker, Vice-President; Edmund Smith, H. H. Houston, William M. Spackman, Charlemagne Tower, Jr., Wayne MacVeagh.

Boston's New Electric Street Car Plant.

President Whitney, of the West End Street Railway Co., of Boston, Mass., started up the finished portion of the plant of the new power house of that company on Monday last, Sept. 28. This new power house is to be the central station and to contain power enough to operate most of the street railways of Boston. The boiler house is 80 ft. wide by 160 ft. long, and will accommodate 24 boilers. The engines are of the triple expansion type, developing some 2,000 H. P. each. When the plant is complete there are to be 13 of these engines with a total capacity of 26,000 H. P. Thomson-Houston generators are to be used, and the engine power is to be transmitted to them through a mass of countershafting and belting far surpassing anything of the kind now in use. The engines are supplied with a condensing plant to full capacity, using water pumped from the South Bay. The company claims a saving of about 10 cents per car-mile by electric power over horse power.

Enlarging Canada's Canals.

The amount of public money expended on the St. Lawrence system of canals in Canada in order to insure the safe passage of vessels of large tonnage from Lake Superior to Montreal, has already reached the substantial sum of $26,000,000, exclusive of the $15,000,000 spent by the British and Canadian governments before the enlargement was begun. A further sum, estimated at $14,500,000, will be required before the contemplated work is completed, of which $12,000,000 will be needed to deepen the St. Lawrence canals proper, the balance being absorbed by the Sault. The highest canal of the series is at Sault Ste. Marie, where there is to be a short canal and single lock of large dimensions, designed to permit a vessel drawing 19 ft. passing at low water. All other canals between Lake Erie and Montreal are to be arranged for a navigable depth of 14 ft. Up to 1876 the intention was to carry out the views of the Royal Commission of 1870, and to make the Welland and St. Lawrence canals of a depth of 12 ft. In the meantime the Welland canal had been completed to the 12 ft. gauge, and had to be subsequently deepened 2 ft. The total cost of this canal, now completed, was in round numbers $16,100,000. None of the other canals between it and Lachine were, however, begun before the greater depth was adopted. On the Lachine, the foundation of the permanent structure was put down to the full depth, at an estimated cost of $1,250,000. For about four miles above the Lachine canal, Lake St. Louis is obstructed by numerous shoals, the removal of which is necessary to form a channel suitable to the enlarged 14 ft. navigation. This also will

require a probable expenditure of $1,250,000. Between Lake St. Louis and St. Francis, a rise in the river of 83 ft., is at present surmounted by the Beauharnois canal on the south shore of the St. Lawrence. After careful surveys and examinations extending over some years, the conclusion has been arrived at by the Dominion Government to build an enlarged scale canal on the north shore at an estimated cost of $4,750,000. In Lake St. Francis the obstructions to a 14 ft. navigation are but slight, the removal requiring an expenditure of but $90,000. The works on the Cornwall canal are all under contract, and the locks nearly completed, leaving, however, a considerable length of the canal to be enlarged at a cost of about $2,100,000. Between the head of the Cornwall canal and Prescott, the main obstruction, that at the Galop Rapids, has been removed, but the William burg canal, together with the necessary river works between the Cornwall and Prescott, have still to be completed at an estimated cost of $2,770,000.

A Mexican Steamship Line.

James W. Porch, of Philadelphia, formerly United States Consul-General to Mexico, has organized the Mexican International Steamship Co., which has a valuable concession from the Mexican government, for a steamship line between Philadelphia and Tampico. It is proposed that the steamships call at the ports of Havana, Cuba; New Orleans, and at Progreso, Campeche, Frontera, Vera Cruz, Tuxpam and Tampico, in Mexico. The Mexican government gives a rebate of two per cent. on all shipments arriving at its ports in the steamships of the company. Mr. Porch proposes to build six freight steamers. He is receiving the support of the Board of Trade and other mercantile societies of Philadelphia.

The Westinghouse Electric Company's Reorganization.

The nearly unanimous assent of the stock and claimholders of the Westinghouse Electric & Manufacturing Co., to the reorganization plan has been secured, and Messrs. August Belmont & Co., of New York, and Messrs. Lee, Higginson & Co., of Boston, announce that they will receive subscriptions at par for $3,000,000 7% cumulative preferred stock. The authorized capital is $10,000,000, of which $4,000,000 is preferred. The balance, $1,000,000, of the preferred stock above the amount offered now for subscription will remain in the treasury to meet the future requirements of the business.

Car Heating.

Judge Childs in the Special Term of the Supreme Court, sitting at Buffalo, N. Y., has granted a continuance of the injunction restraining the New York Central from using other than the Martin Anti-Fire Car Heater Company's devices. The injunction is continued for 60 days from Oct. 7.

Contract Let for a Big Lake Propeller.

Wheeler & Co., of West Bay City, Mich., have closed a contract for the construction of a large steel propeller for Callenbeck and others, of Saginaw, Mich. The new boat will be 345 ft. over all, 42 ft. beam and 25 ft. 6 in. depth. The boat will be after the same pattern as the steel steamship "Emily P. Weed," and will be the largest steel freighter on the Great Lakes, being 14 ft. longer than the "E. C. Pope."

Interlocking.

The Union Switch & Signal Co. has put in interlocking signals at the crossing of the Canadian Pacific and the Erie & Huron at Chatham, Ont. Interlocking signals are also being put in on the Canadian Pacific at Lambton, Ont., and at the River Don, near Toronto. The Union Switch and Signal Co. is also erecting an interlocking plant at the crossing of the Pittsburgh, Fort Wayne & Chicago, and the New York, Pennsylvania & Ohio at Mansfield, O.

A Bridge at Sydney, N. S. W.

We have at hand copies of the map and profile of the site of a new bridge to be built at Sydney, and for which the Government of New South Wales has asked competitive designs. The profile, on which borings are shown about 100 feet apart, indicates the need of some expensive foundations, the rock being, for a considerable distance, about 100 feet below water surface. To reach the rock it will be necessary to penetrate numerous strata of yellow, red, brown, blue and black clay and sandstone and sand. Just above the rock at the bottom of some of the borings sand and fresh water were found, another example of how fresh water is conducted under beds of clay, how far out to sea in this case cannot be told. The bids close Jan. 4, 1892.

Central American Railroads.

The Bureau of the American Republics is informed that the government of Costa Rica has granted to M. C. Keith, of Brooklyn, N. Y., one-sixteenth of the entire public lands, amounting to 800,000 acres, in consideration of which Mr. Keith undertakes to extend the railroad system of the Republic. He has also made a contract with the government for the construction of a suspension bridge over the Revantazon River.

A Kansas company has just obtained from the government of Nicaragua a concession for a railroad to Matagalpa and beyond, about 120 miles in length, carrying with it a grant of nearly two millions of acres of land, including some of the best agricultural territory in that Republic.

More Armor Plate Trials.

A trial of heavy armor plates of American manufacture is to take place this month at the new proving grounds at Indian Head on the Potomac River. There are to be eight plates in all, furnished by Carnegie, Phipps & Co., and by the Bethlehem Iron and Steel Works. Those manufactured by Carnegie, Phipps & Co. are rolled plates, while those by the Bethlehem Iron Works are forged. The plates are to be 10.5 in. thick, and of the usual test plate size, eight feet long and six feet wide, part of nickel-steel and Harvey process, part all-steel and Harvey process, and part all-steel without the Harvey treatment. The above mentioned companies have each purchased foreign processes, and have added such improvements as their experience afforded, so that the trial will present a comparison of methods and capacity for manufacture as well as of the style of plates themselves.

The trials are to be made with a 6-in. 40-calibre and an 8-in. 35-calibre breech-loading rifle with a striking velocity of 2,100 ft. per second, an increase of 25 ft. per second over the trials at Annapolis. Brown prismatic powder of Dupont manufacture will be used and 100-lb. Holtzer armor piercing projectiles of European make are to be fired. The four corners and the centre of each plate are to be struck as at the Annapolis trial, unless some more determined or effective method of destruction may be settled upon.

There seems at this time to be either a lack of ambition or capacity in our American powder manufacturers. While numerous companies are ready to compete for the plate manufacture; and for the gun and projectile manufacture, there seems to be very little desire, except by the Duponts, to enter the lists for furnishing the successful powders. Colonel Hazard, an old leader in powder manufacture, were he alive, would not have allowed this lack of competition, nor would he or his associates of old have countenanced the existence of such a state of affairs. The powder works they organized and operated in war times are yet in existence, but what of the ability of those in charge, are "peace" powders the limit of their capacity?

An Electric Snow Sweeper.

The Thomson-Houston snow sweeper for street railroads was described by Mr. Barr of that company at the Street Railroad Convention in New York City. This machine has attracted a good deal of attention, it having been rumored that it was to be a very powerful piece of apparatus which would clear the streets quickly, and prevent any delays by snow when electric motors are used instead of cables. After examining all of the devices of any moment in this country for cleaning streets, the machine was devised, with a brush of rattan set at an angle of 60 degrees, and revolving in a frame and driven by a motor by means of sprocket chains. In a light snow that brush gave good satisfaction, but in a heavy wet snow the brush would clog, and serve rather to pack the snow on the rail, and make it solid, and therefore interfere with the traction. The sprocket chain is always a source of trouble and annoyance. The new plow now being built has a broom with steel teeth. It is supported from 36-in., 400-lb. wheels, with Bemis journal boxes. The wheels are driven the same as with the cars, the motor being placed on the axle with a single reduction between the armature shaft and the axle. The brush cylinder is set at 45° with the track and extends completely across and is hung on a rocker shaft. The weight of the motor counterbalances the brush and it is geared directly through spur gearing to a "flyer." The flyer is a series of plates resembling the paddle wheel of a steamer, with the plates cut at the centre to make room for the driving gear. The plates are of steel about ¼ of an inch thick, eight of them on each flyer. To the back of the plates are bolted steel wire brushes; the wire is flat and cuts edgewise. The brushes are adjustable and ordinarily their surface projects from ⅜ to 1½ in. beyond the plates. The plates do the major part of the work. They break a heavy snow and will actually cut ice. The steel brush does the rest of the work. It sweeps the road clean and if allowed to remain long enough in one place it will cut the ice as well. The motor driving the broom and brush is independent of the motors driving the car, so that the sweeper can be propelled in a light snow at a sufficieat speed to keep it ahead of any cars on the line. The device has done good work, and is now built with a 25 H. P. motor which drives the plate 150 turns per minute. One of these sweepers will be on exhibition at the coming convention at Pittsburgh.

The Serve Ribbed Boiler Tubes.

The appplication of these tubes to locomotive boilers in the United States is making progress. They have been pretty well known in Europe for some time past. The Paris, Lyons & Mediterranean Railroad after experimenting with them exhaustively for over two years, is now fitting 45 locomotive boilers with them, and changing the tube heads to substitute 2½-in. for 2-in. tubes, finding a better result with the larger size. In the United States, trial sets have been ordered by the Southern Pacific, the Mexican Central, and the Grand Trunk Railway of Canada.

The Trenton Iron Co., of Trenton, N. J., has also ordered a set of 2½-in. tubes for one of their "Manning boilers," and if the result is as satisfactory as the manufacturers hope for, will substitute ribbed for plain tubes in all their boilers. On steamers the economy over plain tubes is found to be about one-sixth, or with the same amount of fuel the capacity of a boiler to produce steam is increased about one-sixth. On locomotives, where high forced draft is used, it is believed that the result will be considerably more favorable than this.

Car Ventilation.

Mr. W. G. Creamer, who is justified in speaking authoritatively of car ventilation, gives in the *Annals of Hygiene* for September, the following formula for the solution of the problem:

"Well, what do you propose to do about it? This: I would first make provision for a constant inflow of fresh air, which in winter I would bring in contact with the heating appliances before its discharge into the car. In summer I would arrange the same heating appliances to cool the air. Before discharging it in the car I would have it as thoroughly screened as possible from cinders and smoke. I would take in the air at a point most free from smoke or gas, and that is on the side of the car on line with the windows. The roof of the car is the worst place possible, especially in tunnels, cuttings or side-hill embankments, or even on open levels, when there is no wind, and the smoke, gas and cinders cling to the roof. There is no such thing as ventilation without the admission of fresh air, and it is all-important to take it in at the best place. It is a vital point also that the air be admitted without violent drafts; no one will stand a cold draft at any time. Openings for the admission of air that are liable to this contingency are not to be thought of. It is vastly better to have numerous small openings throughout the car near the floor. So much for the admission of fresh air. For the outlet of vitiated air apertures provided with registers must be placed on the sides of the clear story about four feet apart, and connected with or opposite each register, and on the outside is placed a self-reversing exhaust ventilator. All the registers on the inside are connected to one rod and operated at the end of the car by a lever handle within easy reach."

The St. Clair Tunnel.

The last of the material to be excavated at the St. Clair tunnel approach is now being taken out, and the stone work of the revetment wall is being completed. Regular traffic through the tunnel will begin Oct. 27.

THE SCRAP HEAP.

Notes.

A convention of the Brotherhood of Railway Trainmen was held at Galesburg, Ill., last week, 400 delegates being in attendance. The order has 21,000 members.

The strike of 1,500 negro freight handlers and other laborers at the steamboat docks and railroad freight stations in Savannah is said to have failed, the companies having secured a fair number of new men.

Elevator "A" of the Baltimore & Ohio at Locust Point, Baltimore, was burned on Sunday last, together with 135,000 bushels of wheat. The insurance on the elevator was $100,000 and on the grain $182,500.

An Atlanta paper says that detectives have arrested and imprisoned a negro who is believed to have had a part in the terrible passenger train wreck at Statesville, N. C., on Aug. 27. They say there is circumstantial evidence of considerable importance against him.

A regular train of the Baltimore & Ohio, which was detained by the burning elevator at Locust Point, ran 92 miles in 92 minutes on Sunday last. The run was from Canton to Philadelphia, and four stops were made. The train consisted of engine and four cars, one of which was a parlor car.

Some time ago the wages of Grand Trunk employés receiving $500 and over per annum were reduced 5 per cent. and those of men receiving $750 and over 10 per cent. This reduction was due to the falling off of the earnings of the road. Traffic has now increased and notices have been sent out that all wages so affected would be restored, the change to take effect from Sept. 1.

The proper conduct of railway affairs is supposed to be attended with a considerable degree of dignity, growing out of an appreciation of the important interests involved. That this sentiment is not universal is evident from a spectacle observed this week at the office of an important railway in Chicago. Standing by the doorway was a regularly authorized representative of the office who, in tones sufficiently loud to be heard above the din of the street, addressed an invitation to the crowd of passers by in the following terms: "Walk right in, tickets bought and sold to all points." When scalpers' methods are thus used, it is not to be wondered at that legislatures meet the railroads on their own ground and adopt measures which are equally indefensible and unjust.—*Railway Review.*

Renewal of Steamship Subsidies.

The Republic of Costa Rica has renewed its contract with the Foxhall line of steamers between New Orleans and Port Limon for four years; with the Kosmos line of Hamburg, Germany, for one year, and with the Atlas line of steamers and the Royal Mail Steam Packet Co. for five years each. These companies receive no subsidies in cash, but a rebate of 5 per cent. is given on the duties charged upon merchandise brought by them to the ports of Costa Rica, and they are relieved from port dues.

Harnessing the Ocean.

There has lately come from India another solution of the old problem of how to utilize the force expended by the surf breaking on the exposed sea coasts. Ever since man's inventive faculty first began to trouble him he has lain awake nights thinking of this enormous amount of power going to waste. In this country the inventor has had more variety, because there was Niagara Falls to be thought about and also the rise and fall of the tide in the Bay of Fundy. But on the long stretches of Indian sea coast the unbroken roar of the billows acts as a monotonous and incessant reproach to man's sense of his own responsibilities. The result is a device which, if all hopes are realized, will turn the wheels of the world with no further effort on our part than to see that the bearings are duly lubricated.

One must fancy a bit of coast with two rows of breakwater made of piles or cribs and so arranged as to form a funnel with the apex toward the shore. This funnel will receive the breakers at a distance, and as they draw near will squeeze them up and concentrate their power at the apex. Here will be placed a vertical shaft carrying at its upper end a water wheel and at its lower end a turbine. The pipe leading to the turbine terminates above in a reservoir. When a breaker gets near enough to the shore it is siezed by the break water and thus confined is pushed right up to the water wheel. During the passage of the breaker its upper part acts upon the water-wheel and at the same time fills the reservoir of the turbine. When the wave ceases to act upon the water-wheel the turbine starts up and keeps the thing moving till another billow can come up and do it again. This may be kept up indefinitely, and the power may be piled up till the sea coast gives out. It is well known that there is no better lubricant than water when it can be had in sufficient quantities, but some over cautious spirit has predicted trouble from a too free admixture of sand. But this is only a minor detail. Now it only remains to roof over the Bay of Fundy and set the moon to doing some useful work, instead of wasting her time stimulating the amativeness of mankind and cats—already overdeveloped.

Distress in India.

Our Indian letter last week gave some details of the short crops in the Punjaub and Northwest Provinces. News from Rangoon of Sept. 15 tells of the condition in Burmah in the northeast. In Upper Burmah rains have improved the situation in some districts, but in others the prospects are very gloomy. Relief works have been started and the numbers employed on them are increasing. Food stocks are low and in some districts rice is at famine prices. In Lower Burmah with a good harvest rice is selling at twice its normal price, owing to heavy exports. The available supply is estimated at little more than one-third that of last year. There will be a great deficiency for three months. The Chief Commissioner reports a very narrow escape of much of Upper Burmah from a water famine and says that irrigation works that have been allowed to fall in disuse must be restored. He is making use of the funds at his disposal for that purpose now, thus providing employment for a distressed population and building for the future.

Twenty-four Hour Time.

A bill has been introduced in the Canadian House of Commons by a member of the Federal Government to authorize the adoption of the 24-hour system of reckoning time by the various Provinces. The decision of such matters still rests with the provincial Legislatures, although, as the authority on trade and banking, the Federal Parliament is called on to fix legal hours for commercial transactions. A high official of the Canadian Pacific says: "We have tried the 24-hour system for several years in the Northwest, commencing at Port Arthur, and it has been a success. We have not tried it in the East. You can do many things in a new country; you may even get people to say '19 o'clock,' and not feel astonished at the sound of their own voices. The people in the West have taken to our new system, and in its application to the road, I consider it offers a great increase of security to passengers. Besides, the 24-hour system is a rational system, and should be in general operation. Four or five years ago, we issued a large number of 24-hour dials for clocks and watches to popularize the idea as well as to advertise the company. I do not see them now much in use, but I am certain they did much to familiarize the people in the Northwest with the new time."

Honduras Central Railroad.

The Chicago & Central American Company has been chartered in Illinois by David Courter, R. L. Martin, J. H. McGill and Horace F. White, all of Chicago, to build a proposed railroad in Honduras. This line will be about 250 miles long, and is to be built from the northwest coast of Honduras to the capital of the state in the interior. The concession was obtained by W. C. Burchard, early this year, while consul at Ruatan, Honduras.

Mr. Courter expects to start for Honduras with a corps of surveyors within two months to lay out the route and complete plans. The line of the projected road is expected to run through forests of timber, such as ebony, mahogany, Spanish cedar, rubber, lignum vitæ, pines and fancy oaks. The concession carries with it a grant of 6,000 acres of land for each mile of road constructed.

No Smoking.

The St. Louis & San Francisco road has followed the Missouri Pacific and has issued an order prohibiting smoking on passenger trains in Texas and Arkansas. This order is issued on account of the State laws requiring separate coaches for white and colored persons, making it necessary to run two smoking cars or abolish smoking. The latter policy is adopted because the company feels that it cannot afford to run two smoking cars on each passenger train.

Obituary.

A recent issue of the New York *Tribune* gives under the obituary heading some speculative news from Baltimore concerning a dividend on the stock of the Baltimore & Ohio. This is the second time that we have noticed Baltimore & Ohio news classified in this way in the *Tribune*, and we begin to wonder if there is any malign intention.

South American Railroads.

The Latin-American Department of the World's Columbian Exposition has received information that the Congress of Paraguay has approved the project for the construction of a railroad, to be known as the Asuncion & Santos Railway, and has authorized a contract to be entered into with the Viscount de Abert, who has obtained a like concession from the government of Brazil for that portion of the road to be constructed within Brazilian territory. This project will be the means of opening direct communication by rail from the sea at Santos, Brazil, to Asuncion, the capital of Paraguay, thus saving thousand of miles in both sea and river transportation, and shortening the time between Paraguay and the United States from 12 to 10 days. The road will extend almost due west, on the 25th parallel of south latitude, from Asuncion, in Paraguay, to Curitiba, Brazil, 525 miles, and then in a southeasterly direction, 110 miles to Santos, which has a fine harbor on the Atlantic coast. From this port more than three-fourths of the entire coffee crop of Brazil is now exported.

The government of Salvador has granted a concession to Paul Orellana and Manuel Trigueras to build a railroad from San Salvador to Santa Tecla, with a branch line to the centre of each town; work to be completed in two years. The government has also authorized a contract for building a state line between Santa Ana and Atoos, connecting with the line already in operation.

The Bureau of the American Republics is informed that the Buenos Ayres & Great Southern Railway Co. is rapidly pushing the construction of its extension from Bahia Blanca to Carmen on the Rio Negro, which, when completed, will make a continuous line of railroad for more than 400 miles south from Buenos Ayres. The Rio Negro is navigable from the sea for light drafts teamers for more than 350 miles, and it is proposed to establish a line of steamers to run in connection with the railroad. Another railroad is being surveyed south from the Rio Negro, via Port Madryn, in the Chubut Colony, to Santa Cruz, within 150 miles of the entrance to the Straits of Magellan. Already a short railroad is in operation in Chubut, and, with the construction of the proposed line, uninterrupted communication will be had from Buenos Ayres to the south of what was once known as Patagonia, opening to immigration and settlement a vast area of rich agricultural and pasture lands.

An Artificial Waterfall.

It was a happy thought on the part of the managers of the Electric Exposition at Frankfort-on-the-Main to reconvert a portion of the power which is taken from the waterfall at Lauffen into a waterfall in the hall of the exhibition. The electric current generated at Lauffen is at a potential of about 15,000 volts and is reduced by transformers at Frankfort to a pressure of about 100 volts, and operates among other machines a centrifugal pump by which a waterfall of 10 metres in height is maintained in constant action.

LOCOMOTIVE BUILDING.

The Central of New Jersey is also in the market for engines.

The Lake Shore & Michigan Southern is asking for bids on 30 locomotives.

The Baldwin Works will build an new engine for the Abt railroad up Pikes Peak, with three cylinders.

The Chicago, St. Paul & Kansas City has increased its order from 15 engines to 25, which are being built by the Cooke Locomotive Works.

The New York Central & Hudson River Railroad is placing an order with the Schenectady Locomotive Works for 41 eight-wheel passenger engines, and 19 moguls.

The Los Angeles Terminal Railroad has just received from the Baldwin Locomotive Works a 10-wheeler, compounded on the Vauclain system. The engine weighs about 52 tons. The Baldwin Works are building another 10-wheeler of the same weight, and two 8-wheelers for the same road. These latter are all simple engines.

CAR BUILDING.

The Chicago & Eastern Illinois has let contracts for 700 cars.

The Chicago, Rock Island & Pacific has let contracts for 1,200 cars.

The Central Railroad of New Jersey has let contracts for 500 gondolas and is also in the market for box cars.

The Savannah, Florida & Western has let a contract to the Madison Car Co., of Madison, Ill., for 500 cars.

The Northern Pacific road is receiving two dining cars, 20 passenger coaches and six mail and express cars from the Barney & Smith Mfg. Co., of Dayton, O., and five sleeping cars from Pullman's Palace Car Co.

BRIDGE BUILDING.

Boston, Mass.—Seven bids were received by the Superintendent of Streets for the construction of an iron bridge over the Boston & Albany tracks on Berkeley street. The work was awarded to the Boston Bridge Works for $4,898, the lowest bid.

The plans have all been completed for the construction of a new bridge to connect "Commonwealth Flats" with South Boston, to cost about $200,000.

De Kalb, Ill.—The County Commissioners have decided to erect a bridge over the Kishwaukee River at this place.

Napanee, Ont.—The work of widening the Grand Trunk bridge near Napanee for the second track has been going on four months, but it will require two months yet for completion. The abutments are from 20 to 30 ft. high and there are eight or nine of them in all, making it slow work. The iron girders are ready to be placed whenever the stone work is ready to receive them. All will probably be completed before the winter sets in.

New York City.—Bids were submitted by six firms for the work on the steel drawbridge over the Harlem River at One Hundred and Fifty-fifth street, and were opened by the Park Commissioners Oct. 7. The detailed bids in each tender are shown in the following table:

Item.	Est. am't.	Pennsylvania Steel Co.	King Iron Bridge & Mfg. Co.	Passaic Rolling Mill.	Anderson & Barr.	Union Bridge Co.	Drake & Stratton
1. Dredging at Pier I., cu. yd.	6,600	$11,550	$11,550	$11,550	$3,300	$13,068	$6,600
2. Steel pneu. caissons, cu. yd.	4,289	158,693	167,271	171,560	171,560	124,895	117,947
3. Cofferdam, Pier III., cu. yd.	2,225	42,275	55,625	44,500	55,625	35,978	55,625
4. For land pier, exc., cu. yd.	1,800	2,700	5,400	1,800	5,400	4,068	18,900
5. Piling, for 40 ft. piles, each	200	1,600	2,200	1,600	1,400	1,728	2,500
6. Piling, over 40 ft. piles, each	600	7,800	7,800	7,200	4,800	7,416	9,000
7. Grillages, M. ft. B. M.	86	3,870	3,870	3,870	3,440	3,153	3,870
8. Crib fenders, cu. ft.	582,540	37,865	40,777	36,408	23,301	35,826	101,941
9. Sheathing, M. ft. B. M.	130	5,850	5,850	5,850	5,200	5,301	5,850
10. Masonry piers, I. and III., cu. yd	2,500	61,250	60,000	63,750	65,000	53,325	75,000
11. Masonry piers, II., cu. yd.	1,000	23,000	24,000	24,500	16,000	19,160	25,000
12. Masonry piers, IV. to VII., cu. yd	3,450	91,425	101,775	91,532	96,600	77,176	94,875
13. Pedestals, cu. yd.	2,300	6,300	6,300	5,600	7,000	6,440	8,400
14. Dressed surfaces, sq. ft.	17,000	15,300	17,000	15,130	34,000	11,620	17,000
15. Watchmen's houses, each	4	6,800	6,000	6,600	6,000	7,140	7,200
16. Metal draw, lb.	2,419,000	132,145	123,369	120,708	104,017	117,321	144,172
17. Turntable, lb.	750,000	61,500	45,750	48,750	50,250	45,450	78,825
18. Metal in fixed spans, lb.	1,360,000	62,561	65,280	65,552	54,808	57,800	63,412
19. Ornament., lump	.....	2,245	2,500	2,000	1,500	1,600	2,245
20. Machinery	.....	14,950	16,000	16,500	16,000	14,800	14,800
21. Flooring	.....	2,250	2,500	2,500	2,250	2,250	2,500
22. Railing, draw, lin. ft.	824	17,716	17,716	19,776	20,600	20,600	17,716
23. Railing, approach, lin. ft.	630	9,840	9,840	8,820	8,820	9,450	9,840
24. Single lamps	64	3,520	3,520	1,920	1,920	1,600	3,520
25. Cluster lamps	8	1,000	1,000	2,200	2,400	2,000	1,000
26. Asphalt sidewalk, sq. yd.	1,690	7,351	7,182	7,182	5,915	6,675	6,675
27. Asphalt roadway, sq. yd.	3,300	20,625	20,295	20,460	13,200	18,645	18,645
28. Grating, lb.	25,500	1,326	1,020	1,275	765	1,020	1,020
29. Gas main, lin. ft.	1,500	2,325	2,325	2,625	750	1,500	2,325
30. Paint, lump	.....	4,500	3,000	2,500	2,500	2,900	1,700
31. Removal of old bridge	.....	4,000	4,000	3,500	6,000	5,000	6,000
Total	.....	$824,131	$840,715	$817,748	$790,321	$716,305	$924,206

Wichita, Kan.—The plans have been prepared for a pile bridge 273 ft. long and 20 ft. wide to span the Little Arkansas River at this place and the contract will soon be let.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Central of New Jersey, quarterly, 1¾ per cent., payable Nov. 2.

Cincinnati, Sandusky & Cleveland, semi-annual, 3 per cent. on the preferred stock, payable Nov. 2.

New York, Susquehanna & Western, 1¼ per cent. on the preferred stock, payable Oct. 26.

Norfolk & Western, $1.50 per share on the preferred stock, payable Oct. 22.

Toledo & Ohio Central, quarterly, 1½ per cent. on the preferred stock, payable Oct. 15.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Annapolis & Baltimore Short Line, annual, Clifford's, Md., Oct. 14.

Atchison, Topeka & Santa Fe, annual, Topeka, Kan., Oct. 29.

Baltimore & Ohio Southwestern, annual, Cincinnati, O., Oct. 14.

Boston & Providence, annual, Park Square, Boston, Mass., Oct. 14.

Chesapeake & Ohio, annual, Richmond, Va., Oct. 27.

Cincinnati, New Orleans & Texas Pacific, annual, Cincinnati, O., Oct. 19.

Cleveland, Cincinnati, Chicago & St. Louis, annual, Cincinnati, O., Oct. 28.

Cincinnati, Sandusky & Cleveland, annual, Sandusky, O., Oct. 21.

Concord & Montreal, annual, White's Opera House, Concord, N. H., Oct. 13.

Denver & Rio Grande, annual, Denver, Col., Oct. 20.

Erie & Huron, special, Sarnia, Ont., Oct. 13, for the purpose of passing a by-law to establish the head office of the company at Toronto, Ont.

Evansville & Terre Haute, annual, Evansville, Ind., Oct. 19.

Franklin & Tilton, annual, Concord, N. H., Oct. 13.

Illinois Central, annual, Chicago, Ill., Oct. 14.

Louisville, Evansville & St. Louis Consolidated, annual, Belleville, Ill., Oct. 15.

New Orleans & Northeastern, annual, New Orleans, La., Nov. 4.

New York, Pennsylvania & Ohio, annual, 30 Euclid avenue, Cleveland, O., Oct. 14.

Northern Pacific, annual, Mills Building, New York City, Oct. 15.

Restigouche & Victoria, special, for purpose of organization, Campbellton, N. B., Oct. 15.

St. Louis & San Francisco, annual, Broadway and Pine street, St. Louis, Mo., Oct. 27.

Western Maryland, annual, Baltimore, Md., Oct. 21.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Society of Railroad Superintendents* will hold its annual meeting in New York City, Oct. 12.

The *American Railway Association* (*Time Convention*) will hold its fall meeting in New York City, Oct. 14.

The *New England Railroad Club* meets at its rooms in the United States Hotel, Beach street, Boston, on the second Wednesday of each month, except June, July and August.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* hold regular meetings at its rooms, in the Gilsey House, New York City, at 2 p. m., on the third Thursday in each month.

The *Southern Railway Club* holds regular meetings on the third Thursday of the months of January, February, March, May, September and November at such points as are selected at each meeting.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of each month at 7:30 p. m. in the directors' room of the St. Paul Union Station, except in the months of July and August.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month, excepting in January, when the annual meeting is held on the second Saturday of the month. The second January meeting is held on the third Saturday. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* hold regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursdays at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* hold regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Mon-

treal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers' of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month, at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 p. m. on the first Friday of each month.

Engineers' Club of Philadelphia.

The report of the business meeting held June 20 is just received from the Secretary. The paper read was by Mr. Charles S. Churchill, of the Norfolk & Western, on Rail Joints. The author condemns the form of angle bar at present used, and refers to one case where two-tenths of the angle bars in a section he observed were broken directly at the joint. This break at the joint he considers proves conclusively that they broke, not when the weight of the wheel was directly over the joint, but when the wheels are between the two ties adjacent to the joint, or possibly, still further away, on account of the rail bending under the wheel about the fulcrum on the joint tie, or about the end of the angle bar, which acts as a fulcrum. The end of the rail under this strain rises, and the top of the bar breaks under the tension. He considers that as all angle bars break in this way, there is no advantage to lengthen angle bars, but rather to give them more section directly at the joint though increase of section cannot be secured with a guarantee of a tight joint, unless the joint be carried beneath the rail.

The plans which accompanied this paper show a rail joint which Mr. Churchill devised over a year ago, which has been on trial for the past year on the Norfolk & Western Railroad. It consists of: 1st. A plate extending under the rail across both joint ties, having a central rib projection directly under the joint. 2d. Two angle bars are so formed that they extend over the flange and under the rail, embracing the central rib of the above described plate. 3d. Of four through the top of the angle bar and web of the rail, and two bolts through the lower part of the angle bar underneath the rib projection of the plate. Another drawing showed a modification of this joint by which all parts of the joint are so designed that they can be manufactured easily by the use of rolls and forge. Professor H. W. Spangler described a method of testing steam gauges which he had seen, in which a piston of one-quarter square inch area was loaded with iron weights, the pressure being carried hydrostatically to the steam gauge, the friction of the piston being eliminated by causing the piston and weights to revolve.

Mr. John C. Trautwine, Jr., drew a comparison between the first of the two joints figured by Mr. Churchill and the joint described in Mr. Creighton's paper read before the club May 17, 1890. In both joints the principal feature is the substitution of a bar resembling two angle bars joined base to base, in place of the usual single angle bar. The Creighton joint has a short piece of inverted "T" rail with its base in contact with the base of the main rail, whereas Mr. Churchill uses a plate, resting upon the two joint ties, and having, between them, a downward projection such that a cross section of the plate at that point resembles the inverted lower half of a rail section. In both joints, of course, this deep portion occupies only the short space between the two joint ties. The following were elected active members: James McCann, S. W. Putnam, Neville B. Craig, D. W. Taylor, John Overn, Abm. Bruner, Charles L. Prince, John V. W. Reynders, Frederick Bloch, O. M. Weand, William J. Smith, Henry Howson, George McCall, George L. Van Zandt, W. W. Stevens, Clarence M. DuBois; and Albert Priestman was elected an associate member of the club.

New York Railroad Club.

The first meeting of the fall season was held at the rooms of the club, New York City, Sept. 17, at 2 o'clock p. m. The President, Mr. Ross Kells, was in the chair. Fourteen members were elected.

The Secretary announced that no paper had been provided for this meeting, principally for the reason that it was thought best by many of the officers and members that it was very desirable that the meetings should have more of topical discussion and less of formal papers. Accordingly a discussion was opened by Mr. G. W. West on the Best Method of Setting Flues in Locomotive Boilers. Mr. West stated briefly the practice on his road and the difficulties encountered. He uses copper ferrules from 1-16-in. to nearly ⅛-in., according to the size of the hole. He aims to reduce a 2-in. flue about 1-64 or 1-32-in., and has a good deal of trouble with leaky flues in the firebox. At the smokebox end he has no trouble. He asked whether other roads find that reducing or swedging the flues is good practice. Mr. Blackall suggested that the trouble might be with the engineers, which Mr. West did not doubt, but still thought that that did not explain the whole difficulty.

Mr. W. H. Lewis has had a good deal of trouble with semi-steel tubes but not with iron. He uses copper ferrules, but does not swedge the tubes; they are drawn down with a taper mandrel, driving the ferrule in around the tubes. Mr. Kells sets the ferrule in the tube sheet first, and Mr. Steinnert had ollowed the same practice, setting the thimble and expanding the flue through the thimble, leaving about $\frac{3}{32}$ in. outside the sheet. Mr. Lewis uses a No. 11 flue, that is, 11 wire guage, and expands it with a Dudgeon tube expander, run by Stow's flexible shaft. The flues are beaded at the back end but not in front. He finds the life of a semi-steel tube about ten months and has a good deal of trouble with them. Mr. Lewis further suggested that if a tube is a little loose it is very easy to put a hand tool in and tighten it, but Mr. West suggested that if that was done half a dozen times there was no flue left. Mr. Lewis controls this by a gauge.

Mr. West has three consolidations built by the New York Locomotive Works, in which the flues cannot be kept tight three months, while with some mogul engines from the same works they have very little trouble. He asked whether any one present had tried flues set in the sheet without a copper ferrule. Mr. Steinnert had tried it a good many years ago on the Erie and gave it up.

This discussion was carried on for some time in a very informal way, Mr. West saying that he had watched the matter carefully and was convinced that it was not the fault of the men, nor was there any trouble with the water. He uses a very good quality of bituminous coal. It was suggested that perhaps his men ran with the door open. This, however, Mr. West denied. He had tried using a layer of fire brick over the forward part of the grate to prevent cold air coming in there, but got no benefit from this. Mr. Lewis was inclined to think that there must be cold air coming in somewhere, either the fire is carried too shallow or the door is left open.

The President called for further suggestions for subjects for discussion at future meetings. Mr. Lewis suggested methods of handling coal for locomotives, that is the best method of getting it from the track on to the engine. Mr. Blackall suggested the care of air brakes as another topic. Mr. Andress was requested to prepare a paper on the qualities and uses of paints.

The meeting then adjourned until the third Thursday in October.

Western Railway Club.

At the meeting of Sept. 15 the annual election of officers took place.

Messrs. C. A. Schroyer, P. H. Peck and A. M. Waitt were nominated for President. The total number of votes cast was 21, of which Mr. Peck received 11, Mr. Waitt six and Mr. Schroyer four. Mr. Peck was elected.

Mr. Lewis was elected First Vice-President; Mr. John Townsend, Second Vice-President.

Messrs. W. H. Marshall and W. D. Crosman were nominated for Secretary. Total number of votes cast 24, of which Mr. Crosman received 22 and Mr. Marshall 2. Mr. Crosman was elected. Mr. Allen Cooke was elected Treasurer.

The Secretary reported briefly, covering the season's history of the club. The membership was now about 225. The publication of the club's proceedings in pamphlet form had proved to be a very satisfactory procedure. The pamphlet had taken honorable rank in the best current technical literature and its continued publication was urged.

PERSONAL.

—Mr. Orrin Ott, Purchasing Agent of the Illinois Central and for 40 years in the company's service has retired.

—Mr. John R. Tanner has sent to the Governor of Illinois his resignation as Railroad and Warehouse Commissioner.

—Mr. Henry W. Rathbone, President of the Elmira Iron & Steel Rolling Mill Co., died at his home in Elmira, Sept. 29, aged 77 years.

—Mr. J. W. Luttrell, who has been Superintendent of the Motive Power of the western division of the Newport News & Mississippi Valley Railroad, has resigned after a service of several years.

—Mr. Robert Newland, one of the original directors of the Erie & New York City Railroad (now the New York, Pennsylvania & Ohio), died at his home at Jamestown, N. Y., last Sunday night. He was 83 years old.

—Mr. Daniel Ripley has this week been appointed "Traffic Manager for Texas" of the Southern Pacific. He has been for several years General Freight Agent of the Houston & Texas Central. He is still a young man.

— Mr. Richard H. Talcott, Vice-President and Chief Engineer of the Seattle & Eastern Construction Co., has resigned, and is now preparing to return to the East. He accepted the position about two years ago to superintend the construction of the Seattle, Lake Shore & Eastern.

—Mr. C. A. Cairns, Assistant General Passenger and Ticket Agent of the Chicago, St. Paul & Kansas City, has been elected President of the Chicago Railroad Association to succeed Louis Eckstein, lately General Passenger Agent of the Wisconsin Central.

—Mr. W. S. Jones, Superintendent of the Western Division of the Rome, Watertown & Ogdensburg, has tendered his resignation, to take effect Oct. 15. Mr. Jones will return to Watertown, where his family resides and where he will enter business.

—Mr. Lorenzo M. Wilson, formerly Vice-President and General Manager of the Mobile & Montgomery Railroad, before its consolidation with the Louisville & Nashville in January, 1881, and a prominent business man of Mobile, Ala., died in that city Oct. 7, aged 82 years.

—Col. A. B. Andrews, Second Vice-President of the Richmond & Danville, said this week, with reference to the presentation of his name to the President for the position of Interstate Commerce Commissioner, that he was not only not an applicant but could not accept the position.

—Mr. W. T. Jennings has resigned his position as City Engineer of Toronto, Canada. He was formerly Chief Engineer of the Ontario & Quebec division of the Canadian Pacific, and had charge of the extension to Detroit. He became City Engineer of Toronto before construction was completed.

—Mr. G. T. Shepard, General Agent for New England of the Erie lines since 1880, died suddenly at Boston, Oct. 2, of apoplexy. He was born in New Haven, Conn., in 1833, and at the time of his death had completed 40 years in the service of the Erie. Before coming to Boston Mr. Shepard had been at Addison and Elmira, N. Y.

—Mr. George F. Carman, formerly President of the Long Island road, died in Patchogue, L. I., this week, aged 64 years. He had been a prominent resident of Long Island for nearly 40 years. He was elected President of the Long Island road in 1870 and served for several years, until the controling interest changed.

—The New York *Sun* prints a portrait of Miss Lizzie E. D. Thayer, Train Dispatcher of the New London Northern at New London, Ct. Miss Thayer has been dispatcher for two years and an operator 13 years. The road is 121 miles long, all single track, with 25 locomotives, and has a train mileage of 600,000 annually. The *Sun* says that Miss Thayer's hours are from 7 A. M. to 6 P. M. She is constantly conscious of her grave responsibility, "but doesn't appear to mind it much."

— Mr. T. J. Milner has resigned his position as Secretary of the Seattle & Montana, and will spend the winter in the East. Mr. Milner first came to Puget Sound in 1883 as an engineer for the Oregon Improvement Co. He remained with that corporation for nearly six years, and during much of the time was Superintendent of the company, and Manager of the Puget Sound Shore railroad. In 1889 he gave up these positions, and was in the East for almost a year. Some fifteen months ago he became Secretary of the Seattle & Montana, and practically the Manager.

—Mr. C. L. Ryder, who succeeds Mr. Ernest Vliet as General Passenger Agent of the Milwaukee, Lake Shore & Eastern, has been General Agent of the company at Chicago since 1887. He has been connected with the service of this road since 1874. Until December, 1880, he was station agent at Manitowoc, Wis., when he was promoted to the post of general traveling agent, which he held until December, 1883. From the latter date until April, 1887, he was local freight agent at Milwaukee. From Milwaukee he was transferred to Chicago. He is now 49 years of age. Mr. Vliet whom he succeeds has been retired owing to ill health and a mental trouble, from which he has previously suffered. He was compelled to relinquish the duties of the position in June, 1890, but was able to take them up again later in the year.

—Mr. C. A. Parker has been appointed Freight Traffic Manager of the Missouri Pacific. He has been Acting Manager for the last five months since the resignation of Mr. J. S. Leeds. When 26 years of age, Mr. Parker was a clerk in Topeka, Kan., in the office of General Freight Agent J. F. Goddard, of the Atchinson, Topeka & Santa Fe road. Later he was clerk in the office of General Agent N. T. Spoor, of the Atchison at St. Louis. For several years he was Chief Clerk in the General Freight Office of the Atchison. In 1886 he was appointed Assistant General Freight Agent of that road at Topeka, Kansas City and Chicago, successively. In April, 1889, Mr. Parker was appointed General Freight Agent of the Atchison, with headquarters at Topeka. He remained there until September, 1889, when he assumed a like position on the Missouri Pacific, under Mr. J. S. Leeds, who was then Traffic Manager. He had been Chief Clerk to Mr. Leeds when the latter was General Freight Agent of the Atchison.

—The appointment of Mr. E. T. Jeffery to be President and General Manager of the Denver & Rio Grande, made last week, was announced a few days after Mr. Jeffery had denied, in Denver, that he had been offered the position, and was a surprise. Mr. Jeffery is President of the Grant Locomotive Works now building near Chicago, and was formerly General Manager of the Illinois Central. His career is so well known that is not necessary to republish it. It has often been called remarkable, and is a record of successive promotions from the time he entered the machine shops of the Illinois Central until he was appointed General Manager of the same road. His connection with the road began in December, 1856, and after filling several lower grades in the service he was appointed Assistant Superintendent of Machinery; then General Superintendent in 1877 and General Manager in December, 1885. He resigned in August, 1889. He is now 48 years old. He has been prominently connected with the World's Fair in Chicago since its inception, and would probably have been elected President of the Commission if he had not declined to allow his name to be used.

ELECTIONS AND APPOINTMENTS.

Brinkley, Helena & Indian Bay.—J. J. Horner has been elected President of this company vice W. H. Wright, resigned. G. T. Updegraff has been elected Treasurer in place of A. G. Kyley, resigned, and J. B. Johnson has been appointed General Superintendent to succeed George Rich, resigned.

Chicago & Alton.—W. E. Westlake has been appointed Superintendent of the Dining Car Service, vice W. E. Meyers, resigned.

Chicago & Ohio River.—E. O. Hopkins, formerly General Freight Agent of the Peoria, Decatur & Evansville, has been appointed General Manager of the Chicago & Ohio River, with headquarters at Evansville, Ind., vice J. D. Livingston.

Chicago, St. Paul & Kansas City.—The Directors have re-elected the President and General Manager, J. M. Egan; Vice-Presidents C. W. Benson and William Louis Boyle, Secretary M. C. Woodruff and Treasurer Colonel Bend. A. B. Stickney was re-elected Chairman of the Executive Board, which is made up as follows: C. W. Benson, Arnold Kalman, Ansel Oppenheim, J. W. Lusk, A. M. Drake, William Dawson and J. M. Egan.

Cleveland, Cincinnati, Chicago & St. Louis.—John W. Riley has been appointed Superintendent of the Peoria & Eastern division, to succeed A. H. Palmerton, resigned. Mr. Riley is trainmaster of the Chicago division.

Concord & Portsmouth.—At the annual meeting of the stockholders last week the following directors were chosen: John J. Pickering, William A. Pierce, Wallace Hackett, Portsmouth; Moody Currier, Walter M. Parker, Manchester; John J. Bell, Exeter, and J. B. Walker, Concord. The Board afterward elected John J. Pickering, of Portsmouth, President; Wallace Hackett, Clerk, and W. B. Stearns, Treasurer.

Cumberland Valley.—A meeting of the stockholders of the company was held at Carlisle, Pa., Oct. 6, at which these directors were chosen: President, Thomas B. Kennedy, Chambersburg; John Stewart and M. C. Kennedy, Chambersburg; J. Herman Bosler and Edward B. Watts, Carlisle; W. W. Jennings, Harrisburg; John P. Green, H. H. Houston, A. J. Cassatt and J. N. Du Barry, Philadelphia.

Denver, Apex & Western.—The incorporators of the Apex Construction Company are: Roswell E. Briggs, Adolphe J. King, Evans L. Roberts, Albert G. Brooks and Edwin Meredith. R. E. Briggs is President of the new company.

Denver & Rio Grande.—Edward T. Jeffery has been elected President and General Manager of this company.

Elmira, Cortland & Northern.—George Richards has been appointed Master Mechanic, with headquarters at Cortland, N. Y., to succed Thomas Kearsley.

Fitchburg.—The following directors were re-elected at the annual meeting in Boston last week: H. S. Marcy, Robert Codman, Rodney Wallace, C. T. Crocker, Augustus Kountze, F. L. Ames, George Heywood, W. S. Webb, Francis Smith, W. H. Hollister, W. A. Russell, E. C. Thayer.

Florida, Georgia & Carolina.—The names of the Georgia directors were published last week. The follow-

ing are directors from South Carolina: W. A. Gaines, Mt. Carmel, S. C.; J. Fuller Lyon, Frank B. Gary and W. O. Bradyley, Abbeville; John W. Ferguson and E. M. Caine, Laurens, S. C.

Georgia Midland & Gulf.—At the annual meeting in Columbus, Ga., last week the old board of directors was re-elected. Col. James E. Granniss was re-elected President; John F. Flournoy, Vice-President; G. Gunby Jordan, General Manager, and T. S. C. Howard, Treasurer.

Gulf, Colorado & Sante Fe.—C. O. Shepherd, formerly Freight Agent of the Sante Fe at Milwaukee, has been appointed Assistant General Freight Agent of this road, with office at Galveston, Tex.

Illinois Central.—The office of General Manager has been abolished, and the duties assumed by the Second Vice-President. The General Superintendent and the Chief Engineer now report direct to the Second Vice-President. The board of directors have established the office of Assistant Second Vice-President, and given that officer direct charge of the purchase of materials and supplies for ordinary use in the service of the company. The duties of the Purchasing Agent will devolve upon the Assistant Second Vice President. C. A. Beck, formerly General Manager, has been appointed to the position.

Indianapolis, Decatur & Western.—R. B. F. Pierce, formerly Managing Trustee of the road, with headquarters at Indianapolis, Ind., has been appointed General Manager.

Interoceanic (Arkansas).—The following are the incorporators: Col. S. L. Shellenberger, McAlister, Indian Territory; S. G. Eddy, Denison, Tex.; J. H. McCarthy, Little Rock; John Degan, E. W. Ross, Huntsville, Ark. The principal office will be in Little Rock.

Iron Range & Huron Bay.—The following is a more complete list of the officers than that published last week: C. H. Buhl, of Detroit, is President; Henry Stephens, Detroit, Vice-President; Theodore D. Buhl, Detroit, Treasurer; Frank L. Dodge, Lansing, Secretary, and Sanford Keeler, of Arvon, Mich., is Superintendent of Construction.

Kansas City, Wyandotte & Northwestern.—The following changes and appointments have been made: M. K. Fleming, General Traveling Passenger Agent, to be General Freight and Passenger Agent, succeeding C. A. Shank, resigned; E. J. Hayes succeeds C. P. Johnson, Superintendent of Telegraph, and Louis Erb succeeds W. P. Borland as Claim Agent.

Knox & Lincoln.—W. L. White, Bath, Me., formerly Superintendent of the Knox & Lincoln, has been appointed Division Superintendent of that part of the Maine Central which extends from Bath to Rockland.

Lake Erie & Western.—The stockholders of the road have elected George F. Baker, Nelson Rodmanson and Edward Tuck Directors for three years.

Louisville & Nashville.—The annual meeting of the stockholders was held in Louisville Oct. 7. The following were elected Directors: August Belmont, J. A. Horsey, Arnold Marcus, William Mertens, Eckstein Norton, J. D. Probst, J. S. Rogers, Thomas Rutter and Jacob H. Schiff, of New York; Edmund Smith, of Philadelphia; M. H. Smith, John A. Carter and John D. Taggart, of Louisville. Officers were subsequently elected as follows: Chairman of the Board of Directors, August Belmont; President, M. H. Smith; First Vice-President, Stuart R. Knott; Second Vice-President, A. M. Quarrier; Third Vice-President, W. J. Wood; Treasurer, W. W. Thompson; Secretary, J. H. Ellis.

Jno. W. Logsdon has been appointed Assistant Superintendent of the Nashville Division, and the Nashville, Florence & Sheffield, vice W. S. Martin, appointed Superintendent of the Owensboro and Nashville Division.

Madison, Illinois & St. Louis.—The directors of this road (the eastern terminals of the Merchants' Bridge), met at Madison, Ill., last week, and organized by the election of C. D. McClure, President; L. M. Rumsey, Vice-President, and John H. Overall, Secretary. Seth W. Cobb and John Whittaker are the remaing members of the board.

Mason City & Fort Dodge.—J. H. Kelly, General Freight and Passenger Agent of the road, having resigned, these departments will for the present be under the management of C. C. Burdick, General Manager of the road.

Mexican International.—James S. Mackie, formerly Secretary of the company, with headquarters in New York City, has been appointed Vice-President, vice E. St. John, resigned.

Michigan Central.—E. L. Lilley, General Bridge Foreman of the Canada division, has resigned and will go to Chicago. J. F. Webster has been promoted to fill Mr. Lilley's place.

Missouri Pacific.—C. A. Parker, General Freight Agent, has been appointed Freight Traffic Manager of that road and the St. Louis, Iron Mountain & Southern, leased, operated and independent lines, with headquarters at St. Louis.

Mr. Roberts, who has been general foreman of locomotive repairs of the shops at De Soto, Mo., has been promoted to the position of Master Mechanic of the Iron Mountain shops, at Baring Cross, to succeed H. C. McKelvy, resigned.

Montgomery, Hayneville & Camden.—The incorporators of the railroad met at Montgomery this week and perfected a temporary organization by electing Hon. Jacob Greil, temporary chairman, and Capt. John W. Durr, secretary.

Owensboro & Nashville.—The stockholders held their annual meeting at Louisville last week. The old board of directors, with one exception, was re-elected; Cushman Quarrier succeeded his brother, A. M. Quarrier. The board is as follows: M. H. Smith, President; Stuart Knott, C. Quarrier, W. W. Thompson, A. W. Bruce, R. H. Ingram and J. H. Ellis. W. W. Thompson is Treasurer, and J. H. Ellis Secretary.

Parry Sound.—At a meeting of the shareholders of this company the following Directors were elected: Claude McLachine, John R. Booth, Charles Nolin, William Anderson, C. J. Booth, Neil MacKintosh and J. F. Booth.

Pennsylvania.—W. W. Lord, Jr., Acting Passenger Agent of the Baltimore district, has been transferred to New York with the title of Assistant Eastern Passenger Agent. S. D. Kennedy, Passenger Agent of the Long Branch district, whose office has been at Newark, N. J., has been appointed Passenger Agent of the Baltimore district, to succeed W. W. Lord, Jr.

St. Catharines & Niagara Central.—Richard Wood has been appointed Superintendent, vice John Vanderburgh, resigned.

St. Louis, Cape Girardeau & Fort Smith.—John R. Jeannin has been elected Secretary of this company, with headquarters at Cape Girardeau, Mo., vice J. A. Hawkins, resigned.

Saltair.—The incorporators are: Wilford Woodruff George Q. Cannon, Joseph E. Smith, James Jack, Matthew White, Angus M. Cannon, L. J. Nuttall, Isaac A. Clayton and G. H. Snell, all of Salt Lake City.

Southern Pacific.—Daniel Ripley has been placed in charge of the traffic interests of the Southern Pacific Co. in the state of Texas, with the title of "traffic manager for Texas." His headquarters will be at Houston.

RAILROAD CONSTRUCTION.
Incorporations Surveys, etc.

Atlantic Coast Line.—The grading is now in progress on the extension of the Jamesville & Washington from Washington westerly along the Pamlico River to a connection with the Albermarle & Raleigh, near Bethel, N. C. The line is about 25 miles long. At present about 250 convicts from the North Carolina penitentiary are employed on the work, and it is expected that it will take about four months to complete it.

Austin & Northwestern.—The change of gauge on this road between Austin and Marble Falls, Tex., 76 miles, was made last week, and the first train over the standard gauge was run Oct. 1. The road will be operated in close connection with the Houston & Texas Central, both roads being controlled by C. P. Huntington. The change of gauge and reconstruction of the line was made at the present time in view of the heavy traffic which is expected to go over both roads from the granite quarries at Marble Falls for the harbor improvements at Galveston. It is probable that the line will be extended very soon west of Marble Falls to the iron mines at Llano, Tex., a distance of 30 miles. A subsidy of $35,000 has been subscribed at Austin to secure the building of the Llano extension from that town. Altogether $100,000 will be donated the company by the two towns to construct the road.

Bath, Small Point & Popham.—The work of surveying this short road east of Portland, Me., was begun last week between Popham Beach, on Casco Bay, and Bath, by P. H. Richardson, of Portland, and a party of engineers. The directors state that the capital stock has been subscribed, and all the money necessary to complete the line has been secured. It is proposed to finish all the engineering work this fall, but to postpone the construction of the line until the spring.

Boise City & Butte.—O. L. Miller, of Boise, Idaho, has completed the preliminary survey of the line from Boise City north to Butte, Mont., which he began last June. Mr. Miller gives the following description of the route: Starting from Boise, it follows up the Boise River and over a low pass of the Sawtooth range to the Salmon River, thence to the North Fork and to the Continental divide, and over easy grades to Butte. The line as surveyed is about 400 miles in length. The heaviest grade is two per cent., and this for only a few miles over the two summits—the Sawtooth and Rockies. The sharpest curvature is 10 per cent. The highest altitude reached is 7,150 ft. above the sea. The general route on the rivers will be on a natural bench from 15 to 25 ft. above the streams. Mr. Miller believes the road can be constructed and equipped for $18,000 a mile. The cost of the survey was paid from subscriptions secured through the Board of Trade of Boise City.

Brooksville & Lacoochee.—The engineers have just completed the survey from Brooksville, about 15 miles east to Lacoochee, in Hernando County, Fla., and as soon as the estimates have been prepared they will be submitted to the contractors. L. Y. Jenness, of Brooksville, is president.

Buffalo & Geneva.—The contractors have laid nearly all the track on the line between Buffalo and Geneva, N. Y. The last section to be completed was that of Bendlinger & Nearing, near West Batavia. These contractors have removed their tools to Woodbridge, N. J. The track is now one mile from Batavia, a distance of 37 miles from Buffalo. Besides this, about 20 miles has been laid on the division under R. H. Broadhead, near Caledonia, and about 24 miles on the Eastern division, from Geneva, under T. M. McCarty, leaving only about 23 miles yet to be laid. It is expected that the tracks will be ready to run trains over in about 30 days.

Burrard Inlet & New Westminster.—The early construction of this road south of New Westminster, B. C., is said to be assured. Benjamin Douglas, of New Westminster, the President of this road and of the New Westminster Southern, states that work on the line will soon begin between the Fraser River and Sumas City, south of the international boundary line.

Camden, Watertown & Northern.—The announcement was made this week that the permanent line had been surveyed and maps filed in Oswego and Jefferson counties, N. Y., for this road. Contractors are now preparing bids for the entire 64 miles, and it is said that the line will be pushed to completion within a year. The new route takes in the Black River manufacturing territory from Dexter to Watertown, N. Y. The scheme is being pushed by a syndicate backed by Austin Corbin, who has been trying to sell the Elmira, Cortland & Northern road to the New York Central. The Elmira road extends from Elmira to Camden, N. Y., and about earns its fixed charges. The Vanderbilts made an examination of the property and declined to buy it. After the absorption of the Rome, Watertown & Ogdensburg road by the Central last March, Mr. Corbin renewed his offers without success. It is supposed that the new extension from Camden is talked about in order to influence the New York Central.

Canadian Pacific.—President Van Horne states that it is expected next season to extend the Glenboro branch from Nesbitt, Man., its present terminus, to the town of Souris, and westward to the Pipestone district. This line will have no connection with the line now being built to the Souris coal fields, but will run westward parallel with it. The road is intended to open up that part of the country mentioned, and there is no objective point in view just now. New stations at Portage la Prairie, Brandon Regina, Calgary and Vancouver are much needed, and the plans for these buildings have been prepared. The work will be commenced just as soon as it is convenient.

Ground was broken last week on the branch between the Ledyard mine, Belmont, Ont., and the line of this road. About 50 men are employed. The new road will run across the western end of the Crow Lake, close to Blairton, and thence southeasterly to the Canadian Pacific.

Carolina Midland.—The tracklaying has been recently begun on the extension southeast of Barnwell and is now progressing rapidly to Allendale, S. C. The 17 miles between these points will soon be in operation.

Charleston & Savannah.—The most difficult part of the Ashley River extension at Charleston, S. C.—near Ashley Junction west of Charleston—has been completed and the balance of the work is now progressing rapidly. All the heavy grading has been finished and the new track will soon be in operation. It is laid parallel to the South Carolina road to the various phosphate mills.

Choctaw Coal & Railway Co.—The receivers have recently revived the project for the eastern extension of this road through Arkansas. Surveys have been made from Wister, I. T., on the St. Louis & San Francisco, the terminus of the line, easterly to Hartford, Ark., and right of way has been partly secured through Sebastian and Logan counties. S. L. Shellenberger, the Chief Engineer, is now making a reconnoissance through these counties toward Little Rock, and the Interoceanic railroad has just been chartered in Arkansas to build the line.

Denver, Apex & Western.—The Apex Construction Co. was organized and incorporated at Denver last week to build this road between Denver and Georgetown, Col. Mr. R. E. Briggs, formerly Chief Engineer of the Denver & Rio Grande, is President of the Construction Company. He says that construction west of Denver will begin in 30 days, and adds that there is nothing to prevent the company from building between Denver and Georgetown this winter. Ordinary winter weather would not interfere with the work. The line has been permanently located from Denver to Georgetown, and several temporary surveys have been made across the range to Leadville. The charter of the railroad company has also been amended, extending the western terminus from Georgetown to Leadville, Col., the mountains being crossed through Argentina Pass. The capital stock is $9,000,000.

Denver & Rio Grande.—Several times surveys have been made by this company to shorten its line between Denver and Leadville. The present route is circuitous, extending south to Pueblo, west to Salida, and north to Leadville. The South Park mountains prevent the construction of a line that is at all direct. The Denver, Apex & Western directors state that they will build a nearly direct line to Leadville from Denver. Chairman Coppell has answered with some figures: It would cost $12,000,000 to build this projected line, which would be 126 miles in length. They could not raise this amount of money at the present time. It would cost 70 per cent. of the earnings of the road annually to operate it. The interest would be $720,000 on the bonds To meet all this the road would have to pay $20,000 per mile, and there is nothing in the population or products of that section at present nor in prospective that would warrant the investment of $12,000,000. These preliminary surveys for this line made last fall cost the company $90,000 and it was money thrown away. That line will never be built during our lifetime.

Drummond & Southwestern.—The company has been incorporated in Wisconsin to build a road from Drummond on the Chicago, St. Paul, Minneapolis & Omaha road, through Bayfield County. The capital stock is $10,000. E. E. Rust is President.

Duluth, Pierre & Black Hills.—General Manager Ward has just returned from the East, where he has had a conference with officers of the Northeastern Pacific, which is to operate the new road. He was told that the first assessment on stock had been made to build the road, and that in 10 days grading would be commenced between Oakes and Aberdeen, and that rails would be laid this year as far as Faulkton, S. Dak., and probably to Pierre. Sixty miles of road has been graded southwest of Aberdeen through Faulkton, and 15 miles out of Pierre, northeast.

Duluth, Red Wing & Southern.—Chief Engineer Danforth is now engaged in making a new survey for the southern end of the line between Duluth and Red Wing, Minn., on the Mississippi River. The survey is made through the western part of Wisconsin, beginning at New Richmond and extending south through St. Croix and Pierce Counties to the Mississippi River. The former surveys south of Duluth were made east of the line now being run.

Georgia, Carolina & Northern.—The track-laying west of Athens is progressing rapidly, and the rails have been laid for a number of miles beyond the Oconee River. All the bridges and the trestles have been completed as far as Jug Tavern, Ga., the last work of this kind having been finished last week. The track will now be laid without interruption for 15 miles to the junction with the Georgia road, and trains will soon be running to Jug Tavern. The road is now in operation as far as Athens, 199 miles from Monroe, N. C.

Grand Rapids Belt Line.—The incorporators of the company filed a charter for this line in Michigan last week. It is proposed to build a short belt line at Grand Rapids, Mich. The capital stock is $200,000.

Hearne & Brazos Valley.—Nine miles of this line has been graded west of Hearne, Tex., to the Brazos River, and tracklaying has just begun, Bracey Bros., of Alexandria, La., being the contractors for laying the track. By having trackage rights over the International & Great Northern the company will have a road from Hearne to Mumford, a distance of 12 miles. The location has been made four miles farther to Steel's store. The report that 90 miles of this road had been placed under contract is incorrect. W. J. Williams, of Hearne, is Chief Engineer.

Hemlock.—This company was incorporated in West Virginia last week to connect the saw mill of Work, Wilson & Co., in Upshur County, with the mouth of Panther fork of Buckhannon River. The capital is $3,500. J. A. Work and others, of Washington County, Pa., are the incorporators.

Houston, Central Arkansas & Northern.—The engineers do not expect to have the road completed until December, and it will probably be January before it will be ready for operation. The bridge over the Red River at Alexandria, La., and one south of Monroe, near Col-

umbia, delay the tracklaying. The former bridge is a large one, and is being built by the Union Bridge Co. The work is going on very fast, and all the piers are now above water, the pivot and north pier being nearly completed. The bridge over the Ouachita River will be finished, and then the track which is now laid to Columbia will be continued south to Alexandria.

Interoceanic (Arkansas).—This company filed articles of incorporation this week at Little Rock, Ark., with a capitalization of $7,000,000, of which $1,000,000 has been subscribed. The road will extend from a point in Crittenden County on the Mississippi River, opposite Memphis, in a westerly direction, through Crittenden, St. Francis, White, Woodruff, Faulkner, Perry, Logan, Yell, Scott and Sebastian Counties to Hartford, on the boundary line between Arkansas and the Indian Territory. A branch will run from a point in Perry County to Little Rock. The total length of the road is 325 miles. The directors are connected with the Choctaw Coal & Railway Co., and a survey for the line will begin at Hartford this month under S. L. Shellenberger, chief engineer of that company.

Iron Range & Huron Bay.—An officer writes further particulars of this road: It will extend from Champion, the centre of the iron region of Michigan, northeasterly to Huron Bay on Lake Superior, and is nearly 50 miles in length. The large stockholders of the road are Detroit capitalists, and no bonded or other indebtedness has been placed on the road. It is now almost ready for the rails, and a large ore dock is in process of construction on Huron Bay, and merchandise docks are already completed. The company expects that the road will be ready for business as early as the middle of next season. The outlet on Lake Superior, where the docks are located, is a fine natural harbor, and the company expects to have a large traffic from the iron product of the Northern Peninsula. The contracts for the rails, and for the equipment of the road have not yet been let.

Kansas City, Watkins & Gulf.—One of the members of the firm of Kennedy & Stone, contractors for the tracklaying, reports 51 miles of track laid from Lake Charles La., north toward Alexandria, and bridges completed for 56 miles. He says it will not be long before work will be resumed on the north end of the line, which has been stopped since the failure of the Prosser Ware Construction Co. of St. Louis.

Kings County (Elevated).—The surveys for the proposed extension from Schenck avenue, Brooklyn, N. Y., the present terminus of this road, southeasterly along Eastern Parkway to Logan street, a distance of about one mile, have all been completed and the contract for the iron work let to the Phœnix Bridge Company of Phœnixville, Pa., who are rapidly filling the order. The grade on the new line will be almost level and there will be five stations, the last at Montauk avenue. The tracks along the last two blocks to Logan street are to be used for storage and switching. The company expects to let the sub-contracts shortly and begin work by Nov. 1 next.

Madison, Illinois & Louis.—This company was chartered in Illinois last week by officers of the St. Louis Merchants' Bridge Terminal Co. The company is a reorganization of the Electric City and Illinois Road, which is about three miles long and controls the eastern railroad approach to the Merchants' Bridge from Madison. The capital stock of the new company is $500,000, that of the old company being $50,000.

Marshall, San Augustine & Sabine Pass.—The engineers who have been surveying this line through East Texas between the Sabine and Neches Rivers have been disbanded. They completed the preliminary survey from Jasper, about 60 miles north of Sabine Pass, running in a northerly course, to Carthage, a distance of 110 miles. The 20 miles from Marshall north to Carthage is being surveyed by a second party. The survey was made under the direction of L. J. Kopke. W. A. Fletcher, of Beaumont, Tex., is President of the company.

New Orleans & Northwestern.—The stockholders at a recent meeting authorized the directors to arrange for the extension of the line to a connection with the Houston, Central Arkansas & Northern, to be built as early as possible. The receivers have submitted a proposition to Morehouse Parish, La., to organize a local company to complete the grading from Rayville to Bastrop, about 20 miles north. About a year ago, when the road was being constructed from Vidalia, the town of Bastrop voted $24,000 for the extension and the parish voted a five-mill tax for ten years. The former subscription has become invalid and the receivers ask that the parish and town grade the road instead of renewing the cash subsidy. To do this it is estimated will cost $35,000.

New Roads.—Right of way has been secured by the projectors of a road which it is proposed to build along the east shore of the Canandaigua Lake from Naples south to Stanley, a distance of about 15 miles. There is a graded roadbed of the Geneva & Southwestern between the termini, which the projectors will utilize, and they also expect to obtain trackage rights over the tracks of the Northern Central from Stanley to Canandaigua.

Railroad surveyors are running a line from the mines at Anaconda, Mont., westerly to the Bitter Root Valley in Eastern Idaho. The line will be about 50 miles long and the survey has been made as far as Grantsdale, Mont., near the state line.

The Mountain Lake Land Co., of Newcastle, Va., owns a large amount of timber land near that town, and A. E. Humphreys, the President, states that a railroad will be built in the spring from the connection with the Norfolk & Western up Big Sandy Creek to the timber track, which is said to embrace 72,000 acres.

The owners of the Grand Central Silver Mine, at Kingston, N. M., propose to construct a railroad about 15 miles long from the mines south to connect with the Atchison, Topeka & Santa Fe at Lake Valley, N. M.

Odessa & Middletown.—W. R. Polk, the projector of this short road in southern Pennsylvania, near the Susquehanna River, states that the work of construction will be begun next week. The right of way has not been secured through all the property, and the landowners threaten to stop the work by injunctions.

Ohio Valley.—J. D. Pritchett, who has been assistant engineer in charge of the surveys for the extension to Nashville, has been ordered by the general manager to organize an engineering party to make a new survey of the entire route from Princeton to Nashville, about 90 miles. A reconnaissance and preliminary survey was made about two years ago through Kentucky under the old management. The first 30 miles from Princeton southwest to Hopkinsville, Ky., on the Louisville & Nashville, has been located and it was expected that that part of the line would be under contract this fall.

Pennsylvania.—It is reported that a survey will soon be made for a branch line from the Baltimore Central road at Chadd's Ford, north to connect the West Chester & Philadelphia road at Westtown Station for the purpose of accommodating the people of southern Chester County in reaching the county seat.

The extension of the Turtle Creek Branch from Stewarts has been completed to Murraysville, Pa., and freight trains are now running over the new road. The extension is about seven miles long, and reaches rich coal lands and new natural gas fields.

Philadelphia & Reading.—Surveys are being completed for the proposed cut-off between the eastern end of the Oreland Valley road, at Edge Hill, near Philadelphia, and the Bound Brook road.

Philadelphia, Wilmington & Baltimore.—Engineers of this company began a survey last week through Caroline County, Md., of the route of the proposed road from Greensboro south through Denton to Federalsburg, a distance of 20 miles. This road was projected a couple of years ago, and a local company was organized to build it. It is believed that if the survey now being made gives a favorable route, the road will be built by the above company. Both Greensboro and Federalsburg are located on branches of the Philadelphia, Wilmington & Baltimore.

Phœnix, Santa Fe & Prescott.—B. Tooby has a contract for building a section on the southern end of the line and has about 200 men working near Phœnix, Ariz. Ter. Work was begun last week and is also reported to have begun on the northern end. The line is to connect with the Atlantic & Pacific near Ashcroft, east of Prescott Junction, and the tracklaying is to begin at that point in a few months. D. B. Robinson is one of the officers.

Pittsburgh & Lake Erie.—General Superintendent Beach states that it will probably be a month before any more of the second track, which the company is building, will be opened for traffic. Work is being pushed at various points along the line between Shannopin and Youngstown, about 23 miles of second track being under construction.

Port Arthur, Duluth & Western.—This track is now laid to Sandy Lake, a few miles beyond Whitefish Lake, Ont., and the contractors have the grading ready for about 12 miles additional toward Gunflint Lake, at the Minnesota boundary line. The ballasting is not completed beyond Whitefish Lake, and many small bridges and culverts remain to be put in.

Rio Grande Southern.—The tracklaying on this road is now completed to Rico, Col., the rails having been laid into that town Sept. 30. Regular passenger trains will probably be running about Oct. 10 from Ridgeway, the northern terminus, 65 miles from Rico, which will probably be the southern end of the track for the winter. Twenty-one miles of track has been laid since Sept. 6, during which time there has also been erected nearly 3,800 ft. of bridges, ranging from 12 to 75 ft. in height, and nine miles of tunnel and difficult grading has been completed.

St. Louis & Birmingham.—Twelve miles of the grading south of the Tennessee River, near Clifton, Tenn., has been sublet to Lane Bros., and other contracts for grading will probably be awarded shortly. George R. Johnson, the general contractor, and L. S. Proctor, the Chief Engineer, are revising the surveys south of Clifton to Florence, Ala.

St. Petersburg & Gulf.—J. B. Pepper and others have recently organized this company in Florida to build a line about eight miles long, on the west side of Tampa Bay, from St. Petersburg south to Disston City, at the southern end of the peninsula. The line will be practically an extension of the Orange Belt.

Saltair.—Articles of incorporation of this company were filed in Utah last week, the capital stock being placed at $150,000. This is the estimated cost of building the road. The route is from Salt Lake City westerly about 15 miles to Great Salt Lake. The motive power to be used will be steam locomotives, unless the county commissioners require that some other power be used.

San Francisco Belt.—This line is now ready for operation along the water front of San Francisco from Francisco street to Broadway, about 1½ miles on San Francisco Bay. The locomotives to operate this section have arrived, and the Harbor Commissioners will order the running of regular trains in about a month, the line having to be ballasted. When the belt-line is completed it will stretch around the entire extent of the harbor, but it will be some years before the entire plans proposed will be realized, as it will take some time to build some portions of the sea-wall which it will traverse.

San Joaquin Valley.—The tracklaying has been recently resumed near Fresno, Cal., after a long suspension due principally to the non-arrival of construction material. The grading has been completed for about 20 miles to near the San Joaquin River. Fitzgerald Bros., of Oakland, Cal., who have the contract for building the first 23 miles north of Fresno, expect to complete the grading to Hamptonville early this month.

Savannah, Americus & Montgomery.—The Montgomery extension has been completed for some time, with the exception of the line through Montgomery, Ala. It is now reported that temporary arrangements have been made to enter the city over the tracks of the Montgomery & Eufaula, and to use the Union station. The company has purchased land on Jefferson and Lawrence streets, where it proposes to erect its own station, and it will soon begin the construction of its track from the main line at Clisby Park, near the town limits of Montgomery. The extension is 90 miles long, and will probably be in operation its entire length in November.

Seattle & Montana.—The track laying on the northern division of this line from a point south of the junction of the Fairhaven & Southern will be completed to Mount Vernon on the Skagit River this week. No track has been laid south of Mount Vernon, but the rails have arrived at Seattle and the gap between the Sillaganmist River near Stanwood and Mount Vernon will be closed in a few days. The balance of the track has been laid.

Shelbyville & Franklin.—This company has been recently chartered in Tennessee by B. J. Campbell, of Franklin, to build a road about 40 miles long northwest from Shelbyville to Franklin, connecting the Louisville & Nashville and the Nashville, Chattanooga & St. Louis.

Southern California.—President Manvel told a committee of the Common Council of San Diego, Cal., last week, who asked if the Temecula division, where washouts occurred last March, would be rebuilt, that the stringency of the money market had made any railroad building out of the question, but that the company will now probably build a line to connect San Diego directly with the northern part of the county, but will not rebuild through Temecula cañon. The new line will probably be located east of the present one, and will be through a good country. Nothing is likely to be done for some time.

Southern Pacific.—The survey made in San Mateo County, south of San Francisco, for what is called the bay shore line of the coast division is being revised by the engineers of the company, and they expect to have four miles of the line from San Bruno to the first tunnel completed before winter.

Springfield, Sedalia, Marshall & Northern.—The surveyors reached Marshall last week, about 145 miles from the Southern terminus at Springfield, which they left last March. The only part of the route not surveyed is the distance between Marshall and the Missouri River, and it will take but a few days to run the line to that point and Miami, the northern terminus.

Tamaqua, Hazleton & Northern.—Nolan Bros., of Reading, Pa., who are building this branch of the Philadelphia & Reading, expect to complete their contract, which includes the grading and masonry between Lofty and Hazleton, Pa., by Nov. 1.

Taylor, Bryan & Trinity.—Maj. B. S. Wathen has completed a preliminary survey between Trinity and Taylor, Tex., and is now engaged on the return survey. He has completed about 40 miles of this east of Taylor to Caldwell, and will reach Bryan next week. He reports the route to be nearly level and that not more than 20 miles will be heavy work.

Texas, Louisiana & Eastern.—The contractors who are working on the road east of Conroe, Tex., have recently increased the number of men working on the grading and now have a large force employed. Kennedy & Stone, who have the contract for about 40 miles of the grading, are preparing at Conroe the contract for clearing the right of way and for part of the earthwork.

Winnipeg & Hudson Bay.—Mr. Hugh Sutherland, President of this road, has left for England. His object in going to England is to float the bonds of the company to which parliament granted during the present session a subsidy of $80,000 a year for 20 years. Alexander Stewart, C. E., and party have left on an exploring tour with a view of the deflection of this line into the Lake Dauphin district. In this connection they will make a thorough exploration of the whole country around the lakes, east and west, and will go as far as Grand Rapids.

GENERAL RAILROAD NEWS.

Allegheny Valley.—It is proposed to make a new issue of stock by this company, and an agreement embodying a plan of reorganization has been prepared. The proposed issue is of $15,000,000 three per cent. cumulative stock, of which $10,000,000 will go to the Pennsylvania Company, $400,000 to the Pennsylvania and Northern Central Railroad companies, and $4,500,000 at par to other parties.

Atchison, Topeka & Santa Fe.—The gross earnings, operating expenses (exclusive of taxes and rentals) and net earnings of the company and its auxiliary lines for August, 1891, were as follows:

	Gross earn.	Op. expen.		Net earn.	Op. mile.
Roads owned and controlled	$3,008,359	$1,389,364		$1,018,995	6,532
Roads jointly owned	125,703	128,502	Cr.	2,799	587
Total, Atchison system	$3,134,062	$2,117,866		$1,016,196	7,119
St. Louis & San Francisco:					
Roads owned and controlled	$609,878	$326,158		$283,719	1,327
Roads jointly owned	122,314	122,431		5	536
Total, 'Frisco system.	$732,314	$448,589		$283,724	1,982
Aggregate, both systems	$3,866,376	$2,566,455		$1,299,920	8,882

The comparative statement of all lines is as follows:

	Gross earnings.	Net earnings.	Per mile.—Gross earnings.	Per mile.—Net earnings.	Mileage.
Atchison system:					
Aug., 1891	$3,134,062	$1,016,196	$440	$143	7,119
Aug., 1890	2,894,092	892,884	407	126	7,110
Increase	239,970	123,312	33	17	9
'Frisco system:					
Aug., 1891	732,314	283,724	393	152	1,863
Aug., 1890	734,807	279,906	396	151	1,855
Inc. or dec.	D. 2,493	I. 3,818	D. 3	I. 100	I. 8
Aggregated general system:					
Aug., 1891	$3,866,376	$1,299,921	$431	$145	8,982
Aug., 1890	3,628,899	1,172,791	405	131	8,966
Increase	237,477	127,130	26	14	16

Central of New Jersey.—The operation of the line on Sandy Hook peninsula ceased Oct. 1 in pursuance of an order of the United States Government, on whose property the tracks are located. The route to be used by the company in place of the one abandoned has been under consideration since spring, and it is believed that work will begin shortly. The plans have been completed but all the right of way has not been secured. The intention is to have the Sandy Hook boats run in future to Atlantic Highlands, where the company will build a 2,800-ft. dock. Then it will connect Atlantic Highlands with Highland Beach with a track, the latter place being the junction of the section now abandoned. The abandoned road is 4 2-10 miles long, while the proposed road has a length of 3½ miles. A drawbridge of 1,000 ft. length will be built across the Navesink River.

Chesapeake & Ohio.—The annual report of the company, gives the gross earnings for the year ending June 30 as $8,127,111, an increase of $905,162 over 1,890; operating expenses, were $5,920,448; increase, $465,291; net earnings, $2,206,692; increase, $499.870; fixed charges, $1,986,882; increase, $82,199; balance, $219,810, against a deficit of $197,881 in 1890. The report says that the Craig Valley and Warm Springs branches have been completed. On account of the inability of connecting steamship lines to handle the railroad's business, it is stated, the owners of the lines will probably increase the facilities as the demand grows. A line between Newport News and England has been established. The only business that shows a less rate is the traffic in coal, which depends on the rates made by other competing companies. The

company reports favorable contracts with new mines for coal for its engines. The report concludes by saying that before long the company would be able to consider the question of paying moderate divideuds on its preferred stock. Fixed charges for the coming year are calculated at $1,904,029. The general balance sheet shows total assets $111,794,779. Liabilities: first preferred, $13,000,000; second preferred, $12,000,000; common, $46,000,000; funded debt, $38,360,016; unpaid coupons, $218,531; accrued interest on the funded debt, $256,270; bills payable to coal operators, $454,373; bills payable for rails, supplies, etc., $452,123; audited vouchers, $1,020,530; sundry liabilities, $32,932.

Chicago, Burlington & Quincy.—The reports of earnings continue to show decreases in the operating expenses of this year over 1890, and the monthly gross earnings are also larger than last year. The statement for August and the eight months makes the following comparison:

Month of August:	1891.	1890.	Inc. or dec.	
Freight	$2,025,122	$1,943,555	I.	$81,567
Passenger	817,124	782,566	I.	34,858
Miscellaneous	319,294	290,108	I.	29,186
Gross earnings	$3,161,810	$3,016,229	I.	$145,611
Operating expenses.	1,817,309	1,961,765	D.	147,456
Net earnings	$1,344,531	$1,051,464	I.	$293,067
Fixed charges	800,000	773,515	I.	26,485
Balance	$544,531	$277,949	I.	$266,582
Since Jan. 1:				
Gross earnings	$20,692,921	$22,674,652	D.	$1,981,731
Operating expenses.	13,290,308	15,260,928	D.	2,060,620
Net earnings	$7,492 613	$7,413.724	I.	$78,889
Fixed charges	6,352.000	6,188,125	I.	163,875
Balance	$1,140,613	$1,225,599	D.	$84,986

Chicago, Milwaukee & St. Paul.—The following statement gives the earnings for August:

	1891.	1890.	Inc or Dec.	
Gross earnings	$2,367,006	$2 322,688	I.	$44,318
Operating expenses	1,712,111	1,570,805	I.	141,306
Net earnings	$654,894	$751,883	D.	$96,988
Two months from July 1:				
Gross earnings	$4,676,558	$4,471,756	I.	$204,801
Operating expenses	3,296,352	3,053,148	I.	243,202
Net earnings	$1,380,206	$1,418,608	D.	$38,402

For September the gross earnings were $3,093,609, an increase of $378,980 over the corresponding month in 1890, while for the first quarter of the fiscal year the gross earnings reached $7,770,167, an increase of $583,782.

Chi ago, Rock Island & Pacific.—The annual report of the company, filed with the State Board of Railroad Commissioners of Kansas, is as follows: Earnings of operating, $17,278,942; operating expenses, $11,268,910; income from operating, $6,010,032; income from other sources, $1,368,357; total income, $7,378,390; interest, taxes, etc., $5,560,770; net income, $1,817,619; dividend, $1,846,232; deficit, $28,612. This company has 1,059 miles of road in operation in Kansas and employs in that state 1,856 men, who received during the year ending June 30, $1,209,520.91, an average of over $2.08 each daily. The estimated gross earnings of the road, including the lines both east and west of the Missouri River, for the month of September, were $1,847,849, an increase as compared with the estimated earnings for the corresponding month last year of $125,242.

The report of a proposed issue of bonds by this company is confirmed. Less than $2,000,000 will be issued in January, and this issue will be against actual additions to the property of the company which has been already paid for out of earnings applicable to dividends. The company has practically no floating debt, and, of course, does not issue the bonds to obtain relief.

Concord & Montreal.—The second annual report of the road for the year ending June 30, shows: Gross earnings, $2,471,698; operating expenses, $1,714,678; total, $1,997,587; balance of earnings, $474,111; balance after dividends, interest on bonds, etc., $5,444.

Illinois Central.—The old "lake front" controversy at Chicago is renewed in the answer filed Oct. 4 by the city of Chicago to the suit brought by the railroad to prevent the crossing of various streets on the South Side at grade. The city says it is not true that the railroad has the exclusive use of the right of way, but that it holds the strip of land within the limits subject to the laws of the state and the ordinances of the city of Chicago. It is held to be the duty of the company to either elevate its tracks or keep the crossings of all streets and alleys now opened free from danger.

Louisville & Nashville.—The annual report gives the gross earnings of the road for the year ending June 30 as: $19,220,728; the operating expenses $12,058,444, and the net earnings $7,162,284. The fixed charges were $4,618,438, and the year's losses on the Pensacola & Atlantic and the Alabama Mineral roads amounted to $205,403. The net earnings, therefore, were $2,338,351, to which was added $717.875, income from other sources, making the net income $3,058,226. The surplus, after paying five per cent. dividend, was $656,226.

The company reports the following earnings and expenses for August and two months:

August:	1891.	1890.	Inc. or Dec.	
Gross earnings	$1,793,054	$1,706,940	I.	$89,114
Operating expenses	1,138,801	1,035,811	I.	102.990
Net earnings	$657,253	$671.129	D.	$13,876
Since July 1:				
Gross earnings	$3,662,845	$3,252,122	I.	$410,723
Operating expenses	2,311,391	2,043,117	I.	271,274
Net earnings	$1,348,454	$1,209.005	D.	$139,449

Manhattan Elevated.—The report of operations of the road for the year ending June 30 shows:

	1890-91.	1889-90.	Increase.
Gross earnings	$9,816,710	$9,302,681	$514,029
Operating expenses	4,975,141	4,854,204	120,937
Net earnings	$4,871,569	$4,448,477	$423,092
Other income	113,000	86,000	27,000
Total net	$4,984,569	$4,534,477	$450,092
Charges	2,387,982	2,050,805	337,177
Balances	$2,596,587	$2,483,672	$112,915
Dividends	1,620,000	1,560,000	60,000
Balances	$976,587	$923,672	$52,915

New York Central & Hudson River.—The gross earnings of the company and its leased lines for September, 1891, were $4,128,055, against $3,215,886 for the corresponding period of last year, an increase of $912,169. For the quarter ended Sept. 30, the gross earnings were $11,887,987, against $9,064,235 in 1890, an increase of $2,823,752. The earnings of the Rome, Watertown & Ogdensburg, $351,523, are included in the September, 1891, statement. For the three months of 1891 that road earned $1,086,080.

Richmond & West Point Terminal.—It was learned last week that the company had sold 2,000 shares of Baltimore & Ohio stock at 97½. The company did hold about 4,000 shares of this stock, some of which had been sold previously, and the balance of which, President Inman says, will be disposed of soon. A rumor that the sale was made to meet interest and rentals, amounting to about $600,000, on the Central of Georgia and the Richmond & Danville systems, was denied. The officers state that the money had been provided entirely out of earnings. The proceeds of the sale of Baltimore & Ohio stock have been used in part to reduce the Richmond Terminal's floating debt. The Baltimore & Ohio stock was bought 15 months ago for 102 and constituted a part of the certificates of shares issued by the trust or syndicate headed by President Mayer.

Seaboard & Roanoke.—At the annual meeting of the company gross receipts from operation were reported to be $771,572; operating expenses, $516,596; net revenue for transportation, $254,975; other sources, $77,146; total available, $332,122.

Sebasticook & Moosehead.—President Van Wart, who controls a majority of the stock of the road, has offered to buy the $18,000 stock owned by the town of Hartland, Me., and pay therefore $4,000 cash. If the offer is accepted he says he will at once equip the road with suitable rolling stock, ballast the road bed and put the road on a business basis. If the town refuses this offer he will abandon the road and stop all business over it in October. The road is eight miles long, extending from Pittsfield to Hartland, and has been in operation four years.

Union Pacific.—More than 50 per cent. of the claims of the Union Pacific creditors are reported to have been already exchanged for the three-year notes, a portion by people who originally refused to sign the agreement.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, Oct. 7, 1891.

Considerable dissatisfaction is expressed both by eastern and western lines in regard to the adjustment of the Indiana, Illinois & Iowa matter, and protests have been entered by some of the lines setting forth various reasons why they think the order should be modified and changed. It is said that the Chicago & Erie has refused to adopt the divisions ordered. A notice of refusal was given by the Michigan Central, the Lake Shore and the Pennsylvania, but they have put the order into effect pending further action.

A report is current that the Nickel Plate, West Shore and Hoosac Tunnel fast freight lines are to be consolidated, and that they are to have an entrance to St. Louis over the Toledo, St. Louis & Kansas City (Clover Leaf Route). Officials here profess to know nothing of such a change.

The Commissioners of the Western Traffic Association were in session Oct. 2 and 3, and heard, among other matters, the question of commissions on trans-continental passenger business. It is understood that the Commsssioners will prepare a report on the subject and present it at the meeting of the Advisory Board next week. They meet again on Oct. 9 to hear an application of the Southern Pacific for reduced rates on canned goods and dried fruits from California to Missouri River and east.

Complaint was made against the Atchison last August for a violation of the agreement of the Western Passenger Association in selling a round trip harvest excursion ticket from St. Joseph to Chicago on the afternoon of the day preceding the authorized date for commencing the sale of such tickets. The line making the complaint found the return part of the ticket in Chicago and entered complaint here. Chairman Finley has dismissed the complaint on a technicality. The agreement provides that complaint shall be filed in the city where the ticket was sold, in this case St. Joseph.

The Western Passenger Association made a rate of fare one way, plus 50 cents additional to cover a coupon admission ticket, for the state fair at St. Louis this week. The Atchison purchased a ticket issued by the Alton from Chicago to St. Louis, without the admission coupon, for $6 and thereon made the same rate "to meet outside competition." Chairman Finley has authorized all Chicago lines interested in the business from points common to the Alton and Atchison between Chicago and Eureka, Ill., to meet this rate.

Lake rates are lower and tending downward. Rates of 1¾ cents are being made on corn to Buffalo, with a light movement. Rumors are again current of a demoralization in eastern lake and rail rates and it is stated that rates on flour are being secretly cut to 15 cents from Minneapolis.

The Commissioners of the Western Traffic Association, on an appeal taken from the Western Freight Association, have established the following rates from Cairo to St. Paul, Minneapolis and Minnesota transfer:

1.	2.	3.	4.	5.
80	65	52	33	26

The following commodities in carloads from Cairo to St. Paul, etc., will be charged the following rates higher than from St. Louis to St. Paul: Pig iron, 50 cents per gross ton; lumber, 3 cents per 100 lbs.; fruits, 6 cents per 100 lbs.; vegetables, 5 cents per 100 lbs.

The same rates are also established from Evansville to St. Paul, etc., as a proportional tariff on through traffic from points south of the southern boundaries of the states of Kentucky and Virginia. This adjustment effects an advance in the present rates from Cairo as follows:

1.	2.	3.	4.	5.
8	5	4	3	2

The Commissioners have also announced a decision on through billing of bullion from Montana points to Chicago. The division formerly in use between the Union Pacific and its eastern connections allowed to the lines east of the Missouri River 23.5 per cent. upon shipments of general merchandise from Helena and other Montana points to Chicago; and at the same time on bullion, ore and matte gave a special division of 19.6 per cent. to the same lines. Subsequently, under the traffic agreement between the Union Pacific and the Chicago & Northwestern, the allowance to the Chicago & Northwestern on merchandise was reduced to 22 per cent. The other lines were subsequently authorized to meet the competition of the Chicago & Northwestern, and the divisions which have been arrived at between these companies have been used upon the interchange of traffic between the Union Pacific and other lines since November, 1890. A tariff is now in effect naming a rate of $10 per ton on black or pig copper and copper matte from Silver Bow, Helena and intermediate points to Chicago. The rate to points on the Missouri River is the same. Shipments of matte were made from Montana to Chicago, consigned via the Chicago, Milwaukee & St.Paul, on which the tariff rate of $10 was charged to destination, and the latter company claimed its division of 22 per cent., but the Union Pacific claims that under its present contract with the Chicago & Northwestern it is entitled to continue the old percentage of 19.6 per cent. to the eastern lines. The eastern lines, including the Chicago & Northwestern, claim the division of 22 per cent., and the Chairman of the Western Freight Association concurred in this view.

Thereupon, on June 11 last, the Union Pacific instructed its agents to discontinue all through billing on bullion, matte or ore, to stations on or reached via the Chicago, Burlington & Quincy, Chicago, Milwaukee & St. Paul, Chicago, Rock Island & Pacific and Wabash. Afterward certain matte consigned via the C. M. & St. P. to Chicago was way billed to Omaha by the Union Pacific at the local tariff rate of $10, and was forwarded by the C. M. & St. P. to Chicago at the rate of $2.20 additional; this rate being claimed by the C. M. & St. P. to be its proper proportion of the through tariff rate; thus making an overcharge of $2.20. The commissioners decide that the attempted discontinuance of through billing by means of a notice to agents was not warranted and through billing should be at once resumed. The Commissioners do not feel authorized to entertain questions in respect to the legality of rates or divisions which were in force on Jan. 31, 1891.

I can see no basis for the reports which were telegraphed to the New York papers on Monday that war on eastbound rates was imminent, save the possible action of the Great Northern in reducing wheat rates from Dakota points to Minneapolis; but the Great Northern has not yet made good its threat to do so.

Traffic Notes.

The Union Pacific on Oct. 1 established the usual demurrage rules at all stations on the road.

The Texas Railroad Commission has issued an order that beginning Oct. 1 all cars not unloaded by the consignees within 48 hours shall be charged for at $3 a day.

The Commission has also issued an order giving general permission to the railroads to charge, on freight between competitive points, the short-line mileage rate, regardless of intermediate points.

The lines in the Southwestern Railway and Steamship Association have agreed upon the following rates on grain in carloads from Missouri, Kansas and Nebraska to Galveston for export, beginning Oct. 15:

West of said line, New Orleans rates to apply, except that from stations on the Atchison, Topeka & Santa Fe between Topeka and Arkansas City via Newton the rates may be: Wheat 34, oats 30 (maximum), corn, 29 cents per 100 lbs.

From the territory on, south and east of a direct line St. Joseph to Atchison, thence via Valley Falls, Topeka, Lomax, Waverly, Garnett, Leroy, Yates Centre, Roper, Independence and Deering to Coffeeville, the rates to be the same as from Kansas City to New Orleans, viz.: wheat 31, oats 29, corn 27 cents per 100 lbs.

The Canadian Pacific now runs tourist sleeping cars three times a week between St. Paul and New Whatcom, Wash., the connection being over the Great Northern to St. Paul and the Bellingham Bay & British Columbia to New Whatcom. Similar cars are run between Montreal and New Whatcom once a week.

From other Santa Fe stations the same difference to prevail as compared with Wichita as may exist to New Orleans, with the further understanding that the maximum rates may be from Santa Fe stations upon wheat 35, corn and oats 30; Wichita rates to be the minimum and same rates allowed other lines from contiguous territory or competitive points.

The Cincinnati and Louisville lines of the Central Traffic Association have agreed that, taking effect Oct. 5, wherever through consignments of grain are delivered to southern lines and a change in shipping directions or destination is required, only one such change will be made, and that only when concurred in by the roads delivering and forwarding the freight at Ohio River points. Such change in directions or destination to be made only upon surrender of original bill of lading or receipt therefor and no change to be allowed when the detention at Cincinnati, Louisville, New Albany or Jeffersonville exceeds 72 hours on any car, or when the car has been in transfer elevators more than 72 hours.

Eastbound Shipments.

The shipments of eastbound freight, not including live stock, from Chicago by all the lines for the week ending Oct. 3 amounted to 59,047 tons, against 57,928 tons during the preceding week, an increase of 1,119 tons, and against 71,823 tons during the corresponding week of 1890, a decrease of 12,776 tons. The proportions carried by each road were:

	Week to Oct. 3.		Wk. to Sept. 19.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	7,747	13.1	8,514	14.7
Wabash	3,580	6.1	3,934	6.8
Lake Shore & Michigan South.	9,432	16.	9,221	15.9
Pitts., Ft. Wayne & Chicago	7,007	11.9	6,131	10.6
Pitts., Cin., Chicago & St. L	8,464	14 3	8,434	14.6
Baltimore & Ohio	4,316	7.3	4,321	7.4
Chicago & Grand Trunk	4,569	7.7	4,2o1	7.3
New York, Chic. & St. Louis	6,051	10.3	5,897	10.2
Chicago & Erie	7,877	13.3	7,878	12.5
Total	59,047	100.0	57,928	100 0

Of the above shipments 3,002 tons were flour, 21,571 tons grain, 2,328 tons millstuff, 1,167 tons cured meats 8,285 tons dressed beef, 1,113 tons butter, 1,455 tons hides and 6,762 tons lumber. The three Vanderbilt lines carried 39.4 per cent. and the two Pennsylvania lines 26·2 per cent. The lake lines carried 135,731 tons, against 153,047 tons during the preceding week, a decrease of 16,283 tons.